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THE INDEX OF OTOLARYNGOLOGY

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XXXI.

FURTHER DATA ON THE DISPLACEMENT
METHOD IN SINUSES.*

BY ARTHUR W. PROETZ, M. D.,

ST. LOUIS.

The initial report of the method of displacement irrigation of the nasal sinuses, published in April, 1926, was a bare outline of the procedure and comprised a very limited number of case reports.⁷ Since that time more cases have been studied and time has permitted a more complete observation of the results obtained.

It is the purpose of this paper to consider these cases and the problems they involve, to outline the method in detail and to discuss the difficulties likely to be encountered. Under proper control and with certain precautions, our percentage of successes in introducing the fluids wherever desired has been high. Failures in injecting sinuses due to lapses in the method have practically disappeared. Failure of fluids to penetrate, due to pathologic changes about the ostia occur, and are considered of diagnostic importance.

*From the Department of Otolaryngology, Washington University School of Medicine.

Read before the Thirty-third Annual Meeting of the American Laryngological, Rhinological and Otolological Society, Atlantic City, May, 1927.

In a recent paper, Dr. Edwin C. Ernst,⁸ who has given much thought to radiographic practices peculiarly suited to the study of sinuses with iodized oils, outlined them in some detail. I am indebted to him for the radiologic portions of this report.

Displacement irrigation depends upon the exhaustion of air from the sinus and its replacement, through the agency of the partial vacuum created, with fluid held in apposition to the sinus opening by gravity.

The degree of vacuum often employed in attempts to empty the sinuses by simple suction, if not actually injurious to the membrane, at least produces a hyperemia which swells the membrane about the ostium and defeats its own purpose. Furthermore, unless conditions within the sinus are mechanically ideal, which they rarely are, and unless the sinus is placed in the proper position relative to its ostium, simple suction cannot possibly accomplish satisfactory evacuation.

By displacement, as we have practiced it, small amounts of air are withdrawn at a time from the sinus by application of mild suction to the nostril. These air bubbles are replaced by droplets of whatever fluid overlies the ostium. Each alternation of pressure introduces only a small amount of fluid, but by repeating the manipulation a number of times the entire sinus may be filled. It is important to place the head in such positions that the fluid in the nasal chamber is kept by gravity in contact with the ostium.

THE METHOD.

No changes have been made in the method as originally described. One of two positions is employed. The supine position is the one of choice for general examination and treatment. In this position filling of the posterior ethmoid and sphenoid cells is more easily accomplished. Some filling of anterior ethmoid and maxillary sinuses occurs at the same time, usually sufficient for diagnosis or treatment. The frontal sinuses are most difficult of penetration, owing to the proportions of the *infundibulum ethmoidale*, and for this purpose the prone position is preferable.

The routine procedure in the supine or sphenoethmoid position has been described as follows:⁷

"1. The patient is placed in the supine position, with his head projecting beyond the top of the treatment chair or table. The occipito-atloid joint is extended until the tip of the chin and the external auditory meatuses are in the same vertical plane. This renders the sphenoid sinus, with its ostium upturned, the most dependent structure in the nasal chamber. A "V" shaped pocket thus occurs at the junction of the face of the sphenoid with the cribriform plate of the ethmoid. (Fig. 1.)

"2. The fluid to be introduced is now allowed to flow into the nostrils from a syringe and comes to rest in this pocket, submerging the ostia of the posterior sinuses. It does not enter the sinuses, as their ostia are of insufficient size to permit the escape of the contained air. (Fig. 2.)

"3. Gentle suction is now applied intermittently to one nostril, the other being closed, the palate and tongue being held in the "K" position to seal the pharynx. Any of the ordinary vacuum appliances will suit, provided that the degree of tension can be controlled. When the suction is first applied, a bubble of air escapes from the sinus through its upturned ostium. On releasing the suction this air is replaced by a drop of the overlying fluid. The process is repeated until the sinus is full; about a dozen alternations usually suffice to accomplish this. (Fig. 3.)

"4. The patient is returned to the erect position, and the fluid remains in situ for an indefinite period (eight hours to several days.) (Fig. 4.)

For injection in the prone position, the patient leans forward or lies face down on a table with the nasofrontal suture and the upper incisors in the same horizontal plane.

Two or three mls. of fluid are now introduced into one nostril with a syringe which fits it closely. On withdrawing the syringe, the nostril is held shut with the finger to prevent the escape of the fluid. Intermittent suction is now applied to the other nostril until the fluid has entered the sinuses. More fluid is introduced if desired, and the process repeated. Injection in this position is accomplished by virtue of the anatomic relation of the posterior margin of the septum to the ostia of the sinuses. With the head in the prone position it is possible, by filling one nasal chamber through the nostril, to submerge all the ostia before any of the fluid spills over the pos-

terior margin of the septum into the other chamber. This septal barrier, therefore, keeps the opposite nasal fossa free from fluid and available for the application of suction. (Fig. 5.)

The frontal sinus, as has been stated, is the most difficult to fill, as its outlet is long and narrow, and bubbles of air are not readily displaced from it. This condition exists also, and fortunately to an exaggerated degree, in the middle ear and the eustachian tube. This tube is a collapsed membranocartilaginous passage in its pharyngeal portion, and so narrow that no air is withdrawn from the middle ear when the vacuum is applied. We have been unable to introduce any fluid into either the middle ear or the tube by this method, which is well, as it eliminates the likelihood of infecting them with organisms from the nose.

TREATMENT.

For treatment the following routine of detail has been adopted by us because it has proven the most effective in its results, and occasions the least discomfort to the patient.

It is advisable before beginning treatment to render the ostia as free as possible, and a mild general shrinking of the membrane with 1 per cent cocain or 3 per cent ephedrin sulphate is resorted to. In case the irrigation is intended for a single cell or group of cells, only the region in question is subjected to astringents.

The patient sits in a small treatment chair, with a back which can be dropped into a horizontal position. The operator sits on a stool behind him, with a towel in his lap, upon which to rest the patient's head. This towel also serves to catch any drop of fluid which may escape from the syringe or the nose and which will find its way into the patient's eye if not quickly caught. This is an especially important precaution with children.

The back of the chair is let down and the patient's head rests on the operator's knees. In this way the position of the head can be readily adjusted, so that the chin and ears are in a vertical line. The suction apparatus is held in one hand while the other manipulates the nostril during suction and introduces the fluid from the syringe, which is preferably refilled as re-

quired by an assistant. It is important to hold the patient as steady as possible, for if he becomes apprehensive and raises his head fluid escapes into the larynx and sets him coughing. For the same reason it is preferable to introduce small amounts of fluid at a time and repeat as often as desired. Two mils. in each nostril at a time is usually tolerated well.

The solution should be nearly body temperature. Warm fluids are better than cool ones, and introduction along the septum is more comfortable and effective than against the lateral wall of the nose.

Any suction apparatus suffices, provided the degree of vacuum can be controlled. Electric or water pumps are preferable, as their action is continuous and can more easily be made to coincide with the closing of the patient's pharynx. The degree of vacuum necessary to effect the introduction of the fluids varies. It should be quite low in any case; never enough to cause the slightest pain.

The makers of a well known glass barreled rubber bulb syringe have kindly designed for me a model whose barrel is calibrated at five and ten mils., and whose bulb produces just the required vacuum for the purpose.⁹

The alternations of vacuum and its release should be slow, say one cycle per second, in order to permit the complete disengagement of the exhausted air bubble from the ostium. This is especially important in the use of lipiodol, as it is viscous, and bubbles rise slowly through it.

The patient should be urged to maintain his palate in the "K" position throughout the procedure, and to breathe through his mouth.

Some operators have attempted to fill the sinuses by a single powerful exhaustion of air followed by a single release. This practice is ineffectual, and dangerous as well as painful. A single instillation should consist of ten to twenty alternations of suction and release, the patient maintaining his position throughout. As he sits up, the towel on the operator's lap is given him to catch any fluid which may escape from his nose. He should be instructed not to blow it, but to allow the solution to remain in situ as long as possible.

We have found it profitable to explain the entire procedure to the patient before laying him down, as his cooperation is essential.

Children and others in whom it is difficult to effect a closure of the pharynx (the "K" position) to maintain suction, should be told to open the mouth wide. This usually produces the desired result, as does the crying of children.

It is only in response to many requests for details that this minute description is inserted here.

SOLUTIONS FOR TREATMENT.

The choice of solutions depends upon the individual requirements of the case. There are certain limitations to be considered, however, which do not apply to simple nasal irrigation.

Any solution which is to be introduced into a sinus must be nonirritating, or the result will be a headache which may be severe and intractable. Furthermore, since the solution is to remain in contact with the membrane for an indefinite and comparatively long period, it must either be stable, or its breaking down products must be nontoxic. Apparently the greatest single function to be accomplished by fluids introduced into sinuses for treatment is the mere mechanical dilution and detachment of the secretions, rendering them less toxic and more easily removed by the physiologic agencies of drainage. For this purpose the lotion of choice is sodium chloride solution. In many cases no further treatment is required.

Imperator⁶ employs a solution of sodium chloride and sodium bicarbonate, and instructs the patient in the use of the method at home with the aid of the rubber bulb suction syringe.

In atrophic rhinitis with troublesome crusting, liquid petrolatum is especially useful, as are also dilute solutions of glycerin. These aid mechanically to prevent the formation of crusts and their attendant fetor. Adams¹ reports eight cases treated with one-half per cent mercurochrome suspended in liquid petrolatum. All obtained considerable relief from crusting and dry throat.

Our best results, from all standpoints, have followed the introduction of a weak solution of ephedrin sulphate. It ranges in strength from .1 to .5 per cent in physiologic sodium chlo-

ride solution. It has the advantage of being stable, and as it is liberated from the ostia in small amounts over a period of many hours, it establishes and maintains drainage effectively. No unpleasant after effects have been noted. Neither adrenalin nor cocain have been employed.

Of bactericides no more is to be expected than to prevent bacterial growth in the sinus contents, although Holmes³ reports favorable results with neosilvol, which he employs as strong at 10 per cent. I have produced headaches with a 1 per cent solution and also with collene, and have abandoned their use on that account. It is Holmes' experience that after the headaches disappear there is relief from the original symptoms. Dilute aqueous solutions of phenol and iodine are well tolerated, especially in chronic conditions.

With the idea of digesting thick viscous secretions within the sinuses and permitting them to drain more readily, I have introduced enzymol solutions and suspensions of caroid in glycerin and water, but the advantages of these over the saline solutions were not apparent. These observations included a few cases of atrophic rhinitis with crusting.

Thus far I have no experience with glucose solutions. Several instances are reported of relief from headaches immediately following the injection of lipiodol for diagnostic purposes. Granger³ mentions a case in which there was continuous headache, day and night, for four weeks, which disappeared promptly and completely following an injection of lipiodol for diagnosis.

Potts¹² cites the case of a woman in whom an incessant headache of several weeks' duration was similarly relieved. I have encountered several such instances. In one or two the relief was permanent.

These are isolated cases, and while no conclusions may be drawn from them, they deserve mention.

From a study of the available case reports (about 250), it appears that the best results, from the standpoint of cures, are to be expected in those cases which have passed the acute stage, but in which a swollen mucosa interferes with drainage and a purulent discharge continues over an indefinite period of time. Such cases frequently recover after a few irrigations.

While good results are reported in acute cases, I have no experience with them, as I am not persuaded of the safety or the logic of the procedure.

Chronic cases in which extensive tissue changes have taken place cannot be expected to yield to irrigation. The relief from symptoms, however, is often pronounced and immediate. Persistent postnasal dripping, dryness and headaches frequently improve or disappear.

Old postoperative cases with extensive scarring and an annoying discharge are made comfortable.

W. L. Post¹³ has permitted me to examine the records of twelve of his patients who have improved or recovered under irrigations with normal sodium chloride or a solution of phenol (.6 per cent) and iodine (.1 per cent) in petrolatum. In five of these some eye disorder was the outstanding complaint. Each of them exhibited a sub-acute nasal inflammation and all were relieved of symptoms. One case of iritis, which became steadily worse under atropin locally and nasal irrigations, began immediately to improve when the displacement method of nasal irrigation was substituted for the ordinary method, although the same solutions were used. Of the nasal cases, sub-acute inflammations disappeared promptly and entirely; in hyperplastic types relief from symptoms was accomplished.

Similar results were noted in a series of nine cases treated by Truex.¹⁴ Four patients with subacute posterior sinus disease recovered completely; two with subacute and three with chronic sinusitis obtained relief. One of the latter was a case of atrophic rhinitis. The subacute cases were of three to six weeks' duration, and not more than five treatments were administered in any case.

SOLUTIONS FOR DIAGNOSIS.

Radiopaque substances introduced into sinuses must be bland and fairly fluid; and they must be nontoxic to the sinus mucosa and to the digestive tract as well.

My experience is limited to lipiodol, iodipin and lipiodine. Contrastol has not been available.

So far the most satisfactory shadows have been obtained from a mixture of equal parts of lipiodol¹¹ and olive oil.

This mixture is nonirritating and headaches have not followed its use. Its viscosity is relatively low, and it does not produce the dense metallic shadows of the pure lipiodol. This is an advantage in that the outlines of overlapping cells can be distinguished, and in many cases filling defects produced by cysts or polyps can be seen which are completely masked by the undiluted oil.

Some of the silver salts ordinarily used in treatment are fairly radiopaque. In a series studied by McMahon, neosilvol was found to cast the densest shadow. A 20 per cent solution of this salt is about one-half as dense to the X-ray as the diluted lipiodol mentioned above. (Fig. 6.) It will be seen in the illustration that ordinary liquid petrolatum is practically transparent to X-rays and may be employed for flushing the nasal chambers to remove any excess lipiodol before making the pictures.

In introducing these oils by displacement, the alternations of suction and release should be somewhat slower than for treatment solutions on account of their greater viscosity.

From five to ten mls. of the oil are instilled. After its introduction it usually remains in place for some time, so that the injection may be accomplished in the laryngologist's office and the patient sent to the X-ray laboratory at some distance. He should be cautioned against blowing his nose in the interval.

A mild saline cathartic is usually administered after an examination with lipiodol, although in our experience no digestive disturbances or absorption symptoms have resulted when this was omitted.

RADIOGRAPHIC DATA.

In making a diagnosis by this method the correct relations of head, X-ray beam and film are of paramount importance. The horizontal X-ray beam is the preferable tube position.

It is not always possible and seldom desirable to effect a complete filling of the sinuses with iodized oil, and consequently two positions are necessary to exclude abnormalities of the entire sinus wall.

The original sphenoethmoid position in which the oil was introduced is a convenient one for the lateral exposures (Fig.

7.) An additional lateral film should then be made after a sagittal rotation of 180° . That is a nearly erect position, with the external auditory canals this time above the chin but still in a vertical plane (Fig. 8). The X-ray beam remains in the same lateral horizontal direction.

Dr. Ernst has employed various other positions in special cases, namely, those of Granger,⁴ Pfahler, Hirtz, Waters, Pirie and Aspray.²

Posterior anterior views with the beam still horizontal have given us the best results in the observation of frontal and maxillary sinuses (Fig. 9); the lateral position for ethmoids (Fig. 10). Stereoscopic plates with lipiodol prove most useful in delineating the topography of the cells.

In regard to the technic of exposure, Ernst⁸ says:

"For the average lateral skull examination we adopt a comparatively simple radiographic technic, limiting the fine focus radiator tube to 10 milliamperes and five seconds' exposure. The average potential approximated 76 to 80 K. V. ($4\frac{1}{2}$ inch spark gap) at an anode film distance of 28 inches. The exposure time was doubled in the posterior anterior or semilateral views. By means of this radiographic formula clear and distinct radiograms are uniformly obtained. The diagnostic value is relatively dependent upon sharp and contrasting negatives, showing absolutely no movement. Therefore, complete immobilization is the final radiographic requisite in the various positions of the head above described." Plates held against the patient's head by an assistant while the exposure is being made rarely prove satisfactory. They should be supported by some rigid mechanical contrivance.

In the matter of interpretation of the negatives made by this method, I wish to maintain the utmost conservatism; still, after the experiences of a little more than a year, I feel that the method offers at least these two distinct advantages: first, that no cells are overlooked in the filling, and second, that the readiness with which they fill and empty themselves of the oil is an index of their drainage, which is of prime importance in determining the type of treatment. To quote from a previous report:⁸ "It is frequently impossible to locate the ostium of a sinus, especially in the presence of hyperplasia, and puncture

must be resorted to. This in itself is undesirable, aside from the obvious fact that only those cells which are encountered by the trocar are injected. By the displacement method the oil itself seeks them out. All cells from which a bubble of air can be extruded are at least partly filled, and from this circumstance arises an important diagnostic indication, namely, that the facility with which the oil penetration occurs is a direct index of the patency of the ostia. Not only can general obstruction to drainage be demonstrated but individual cells are shown to be obstructed while others are clearly free. Many cases are encountered in which a posterior ethmoid sinus, for instance, fills readily, while its adjoining sphenoid fails to fill at all, although the oil levels in the normal cells show the head in the proper position and the diseased ostium properly submerged."

If a sinus fills readily under mild suction, it may be safely assumed that it drains freely under ordinary circumstances, regardless of apparent obstruction by turbinal and septal distortions. On the other hand, if a cell fails to fill it may be deduced that its ostium is not normally patent, as the other factors involved in the instillation can be readily controlled.

Hyperplasias of the sinus mucosa, in order to be visible on the plates, must obviously be macroscopic in extent (Fig. 12), and for this purpose absolute fixation of head and film is necessary. But lesser hyperplasias which cannot be so demonstrated may manifest themselves by the failure of the ostium to admit the fluid. Such plates occur not infrequently in our series. Gross hyperplasias, cysts, polyps and foreign bodies are, of course, distinctly outlined (Figs. 13 and 14).

The factors which determine the entrance of the oil into a cell are suction, apposition of oil to the ostium, fluidity of oil, patency of the ostium and presence of air in the cells to be displaced. As all but the last two can be readily controlled, nonfilling under proper technic indicates an obstructed ostium or a cell filled with some exudate or other matter. In any case in which some cells fill and others do not the presumption is that the nonfilling cells are the diseased ones.

Case No. 6 in the first reported series⁷ was illustrative of a sphenoid which failed to fill, although the corresponding pos-

terior ethmoid filled readily. A later radiograph made after four saline irrigations showed normal filling of both cells (Figs. 15 and 16).

Other cases in our series substantiated this observation. One of particular interest is a young man in whom, after careful routine examination, the diagnosis of sinusitis of all posterior cells and the right antrum was made. Lipiodol introduced by displacement, however, entered all the posterior cells freely with one exception, an ethmoid cell on the right side (Fig. 17). In view of this ready penetration a course of saline irrigations was resorted to. After two months the entire nose became free of pus with the exception of the cell which had failed to fill in the beginning. Exenteration of this one cell had finally to be resorted to.

Cases of vasomotor rhinitis, both seasonal and nonseasonal, have resisted our attempts at injection. Beyond a few scattered droplets we have never succeeded in accomplishing any penetration.

Instances are encountered of the unusually extensive pneumatization of the pterygoid process of the sphenoid, to which Sluder¹⁰ recently directed attention in connection with eustachian salpingitis. It not infrequently happens that lipiodol in the sphenoid lies so much lower than the level which roentgenologists are accustomed to regard as the floor of the cavity that they miss its presence altogether in the lateral view and report "no penetration of the sphenoid cells" (Fig. 18).

In a case of Dr. H. W. Loeb, there arose a question of drainage of the anterior ethmoid cells, which had been laid open some years before. The lipiodol was easily introduced here and escaped again at a mere tilting of the head, demonstrating the drainage to be perfect and also outlining clearly the region of the lamina papyracea which was under suspicion (Fig. 19).

Mullin has injected a pneumatized posterior clinoid process. (Fig. 20.)

Appreciating the fallacy of drawing conclusions from an insufficient number of cases, I refrain from including any observations which have not been repeatedly substantiated, but I am convinced that much additional information can be gathered by this method which is too indefinite to set down here

but must come through the operator's own experience. The study of sinus treatment is largely the study of drainage in individual cases; the method is presented as a means of studying this important function and of maintaining it as well.

1000 BEAUMONT BUILDING.

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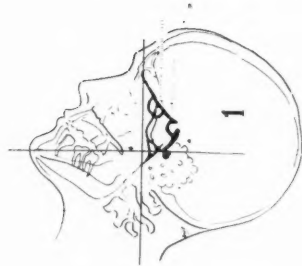


Fig. 1.

Fig. 1. Diagram indicating the correct position of the head for displacement irrigation. The tip of the chin lies in a vertical plane with the external auditory meatus. The parts immediately concerned are heavily outlined. Note the slope of the posterior pharyngeal wall.



Fig. 2.

Fig. 2. The introduction of fluid into the nostril. It comes to rest in the nasal chamber, and submerges the ostia, but does not penetrate the sinuses, as the ostia are too small to permit the interchange of fluid and air.

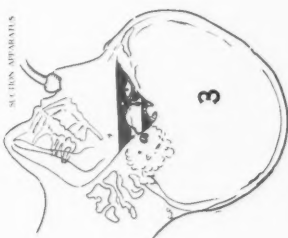


Fig. 3.

Fig. 3. Intermittent suction is applied at the nostril, withdrawing bubbles of air from the sinuses and permitting their replacement with drops of the overlying fluid. Sphenoid and posterior ethmoid cells are shown half filled.

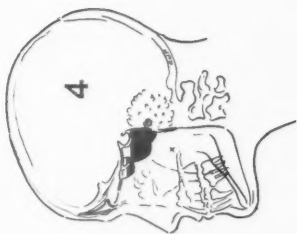


Fig. 4.

Fig. 4. Patient returned to the erect position. The fluid remains in the sinuses.

Fig. 5. Diagram illustrating the prone position for displacement. Again the parts concerned are heavily outlined. If one nasal chamber be filled, the dashed line and its ostia on that side will be submerged without sinking the oil over the margin of the septum into the other chamber. This other chamber can then be utilized for the vacuum application through the nostril.

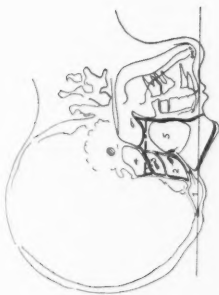


Fig. 5.

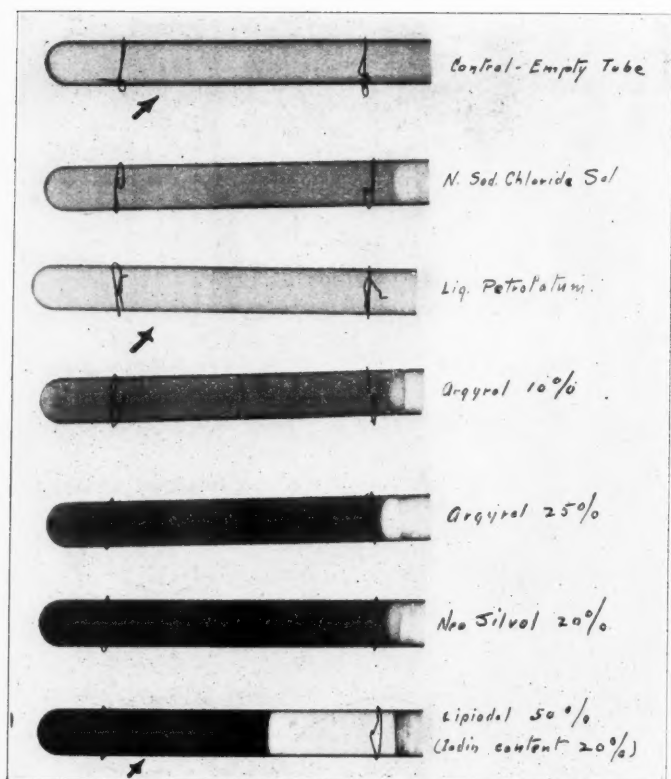


Fig. 6. Radiograph of tubes of various solutions. Note particularly the opacity of the bottom tube, which contains equal parts of lipiodol and olive oil. The following plates were made with this mixture. Liquid petrolatum (third from the top) is practically transparent to the X-rays and may be used for washing the excess lipiodol from the nasal chambers before making the exposure. (Plate supplied and publication kindly permitted by Dr. B. J. McMahon.)

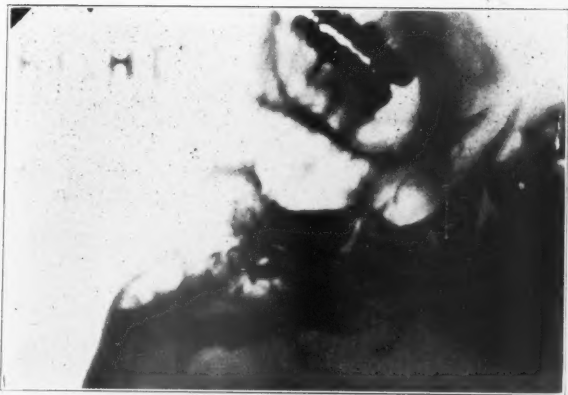


Figure 7. Lateral plate made in the position in which the displacement was done. (Horizontal X-ray beam.) It outlines the upper half of the cells.

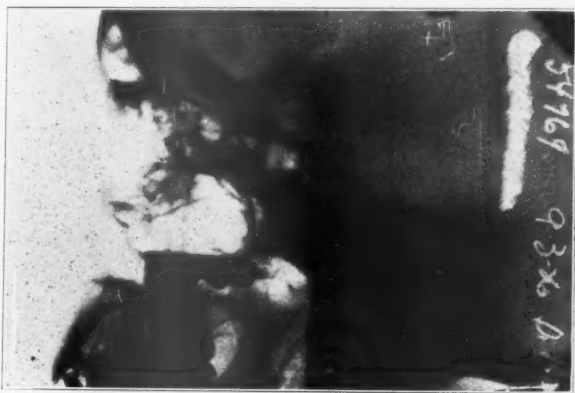
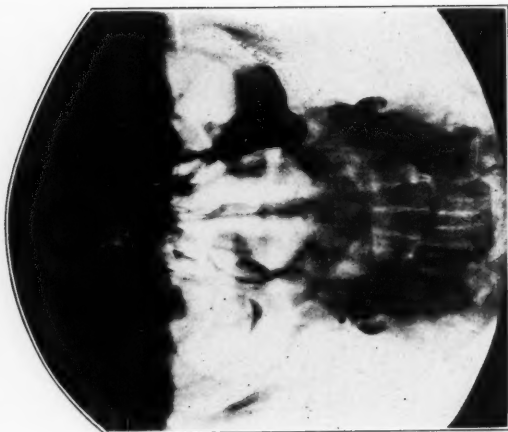


Fig. 8. The same, in the erect position. This plate indicates the extent to which 10 mils. of oil may penetrate the cells at a single filling. The relation of dental root and antrum is of interest.



A



B

Fig. 9. Posterior anterior views of the head shown in Figs. 7 and 8. (A) Waters' position; (B) Granger's position. This study of the sinuses in the left print demonstrates the unsatisfactory mapping obtained with a vertical X-ray beam. The sinuses are mostly obscured by an irregular pool of oil and yields no information in regard to the sinus wall, as do the preceding plates, made with the beam horizontal.

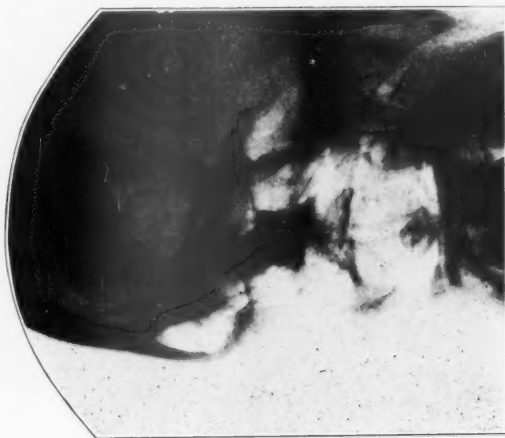


Figure 10.

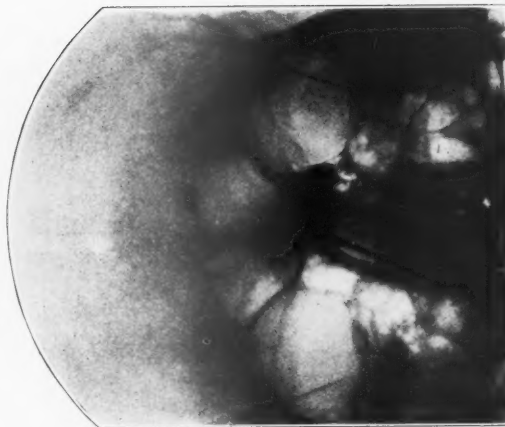


Figure 11.

Figs. 10 and 11. Mapping of a right anterior ethmoid with five mils. of oil introduced in the prone position.
(Experimental series.)



Fig. 12. Lipiodol mapping of a sphenoid, which observed empty showed no abnormalities. The thin white line between the floor of the cella turcica and the oil is interpreted to indicate a thickened membrane, as is the translucent strip on the right (floor of the sphenoid cell). This was verified at operation.

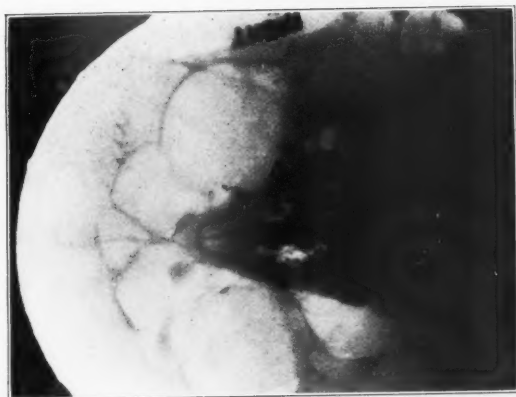
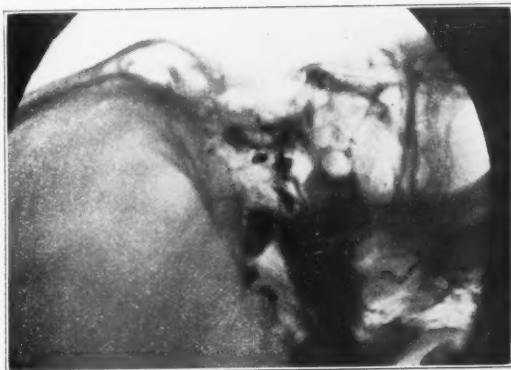


Fig. 13. (A) Lateral and (B) posterior anterior views of the right maxillary sinus, showing an intrinsic filling defect. Unilateral filling in prone position, five mils. oil.



Fig. 14. Typical intrinsic filling defect of the right maxillary sinus. Unilateral instillation in prone position, five mls oil. Exposure with head erect, X-ray beam horizontal. Only a small amount of oil entered the sinus, owing to the presence of a mass of polyps. The thin sheet of oil resting on the top of these, photographs densely because the beam traverses it horizontally. Note similar density of the drop on the velum palati.

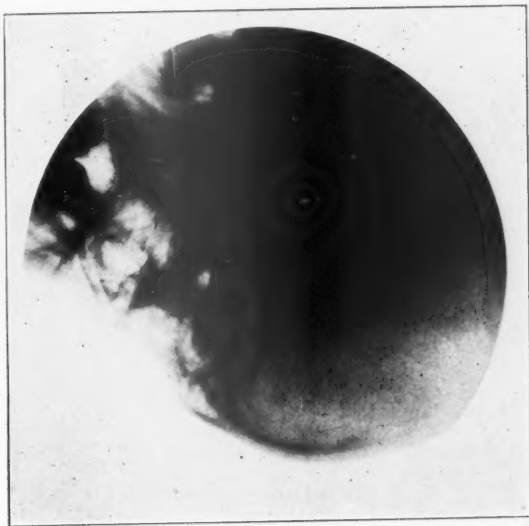


Figure 15.

Fig. 15. Lateral plate taken in supine position, horizontal beam, five mils, oil, unilateral instillation. At this time (January 12, 1926) oil penetrated into the posterior ethmoid cells, but not into the sphenoid, although sufficient oil was used, as is indicated by the shadow in the nasal chamber, and the oil levels indicate the position to have been correct.

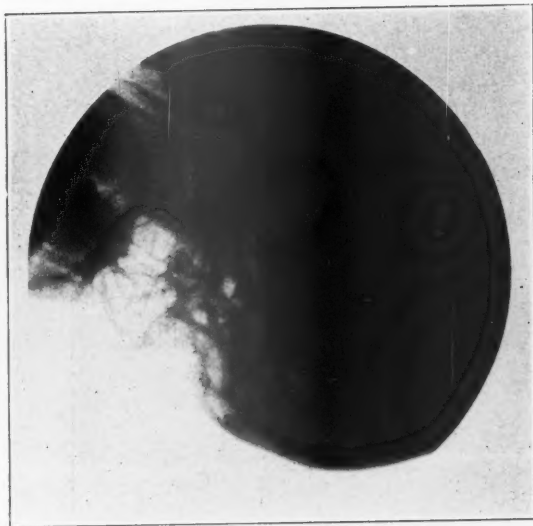


Figure 16.

Fig. 16. Same patient, five weeks later, showing sphenoid now filling. The treatment in the interval was limited to four displacement irrigations, employing physiologic sodium chloride solution. Headache and vomiting disappeared after the initial instillation.

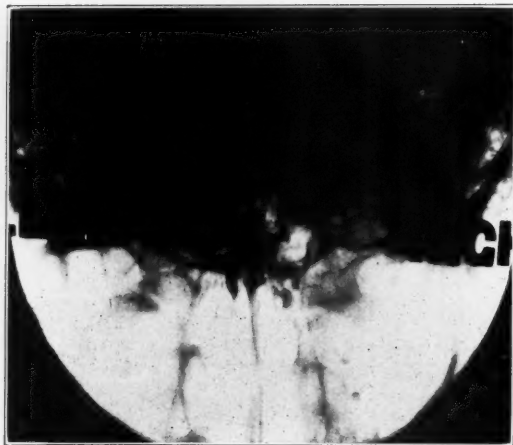


Fig. 17. Posterior anterior view of the posterior cells. Although clinical examination showed pus pouring from all posterior cells and the right antrum, the lipiodol penetrated all the posterior cells except the one on the right. Numerous saline irrigations rendered the nose almost free from pus, but the cell in question required surgical drainage before this could be eradicated.



Fig. 18. Unusually extensive pneumatization of the pterygoid process of the sphenoid is sometimes encountered, or the sinus proper may extend so much lower than the usual level that the presence of the lipiodol may be missed in the lateral view. The arrow on the above plate indicates lipiodol in this position.

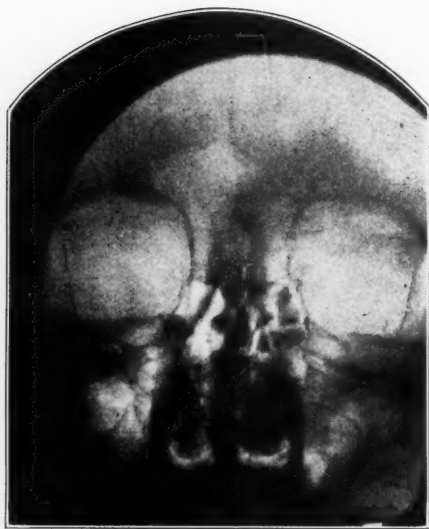


Fig. 19. Posterior anterior view with lipiodol instillation of the right side, made for study of the cells contiguous to the eye, in a patient who complained of pain which centered there. The question of drainage arose, the anterior ethmoid cells having been opened several years before for that purpose. The plate shows lipiodol in the cells under observation. It will be noted that the plate was made in the prone position with a vertical beam. This was necessary, as the oil poured from the cells as soon as the patient assumed the erect position, demonstrating the adequacy of the drainage. (Case of Dr. H. W. Loeb.)



Fig. 20. Lateral views of a sphenoid cell, with pneumatized posterior elmoid processes. (A) plate without lipidol; (B) plate with lipidol, exposure in the supine position, as indicated by the oil levels; (C) the same in the erect position. The fact that the oil remains in place in this position indicates a narrow communication between the elmoid and the main cavity. (Case of Dr. W. V. Mullin, who supplied the plates and kindly permitted their publication.)

THROMBOSIS OF THE SUPERIOR LONGITUDINAL
OR STRAIGHT SINUS BY EXTENSION FROM
THE LATERAL SINUS: REPORT OF
THREE CASES.*

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MAYO CLINIC,

ROCHESTER, MINN.

The extension of infection from diseases of the temporal bone to the cranial sinuses was not recognized until long after brain abscess and meningitis of otitic origin were well known. Earlier observers encountered patients in the last stages of the disease, whereas nowadays patients in extremis from sepsis due to infection of the blood originating in the temporal bone are rather infrequently encountered. It is still more unusual for death to occur as a result of extension of sinus thrombosis to other cranial sinuses. The diagnostic acumen of aural surgeons and the recognition of untoward symptoms by the profession in general medicine has materially reduced the mortality of septicemia originating in disease of the temporal bone, because of earlier recognition of the dangerous condition and institution of well directed surgical measures.

It has been shown that the superior longitudinal sinus passes into the right lateral sinus and the straight sinus into the left lateral sinus in about 50 per cent of cases. Occasionally there is a small communication in the region of the torcula herophili. In 30 per cent of cases the longitudinal and straight sinuses bifurcate, one branch of each passing to the lateral sinuses. In the remaining 20 per cent the sinuses are fused at the torcula.

Abercrombie, in 1816, described finding at necropsy a thrombus that extended into the torcular herophili and into the ter-

*Read before the Eastern Section of the Otological, Rhinological and Laryngological Society, New York City, January 8, 1927.

mination of the longitudinal sinus. Ballance believes that this report is one of the earliest in which a clear record is available. No attempt has been made to review the literature completely, but one interesting reference was found: that of Holmes, in 1906, in which an operation for sinus thrombosis involving the lateral and superior longitudinal sinuses was described. A channel was made through the bone, and the wall of the sinus was uncovered throughout the extent of the lesion. The patient lived. Doyle, of the Mayo Clinic, recently studied case histories of thrombosis of the longitudinal sinus from all causes, from which he drew the following conclusions:

"1. In the absence of meningitis, the early onset of apathy or stupor in a patient with evidence of thrombosis of the transverse sinus secondary to suppurative otitis media generally indicates thrombosis of the superior longitudinal sinus by retrograde extension, especially if associated with choked discs and convulsions.

"2. When the probability of the presence of tumor or inflammatory disease can be excluded, jacksonian seizures showing progression from one foot to the other, or beginning in the foot and gradually involving the homolateral upper extremity . . . suggest impairment of the circulation of the cerebral veins and probable thrombosis of the superior longitudinal sinus.

"3. Abrupt onset of symptoms of increased intracranial pressure which follow a fluctuating course should bring to mind the possibility of thrombosis of the superior longitudinal sinus as well as ventricular tumor. The absence of the element of progression after a fair length of time, or actual regression of symptoms, is suggestive of thrombosis of the superior longitudinal sinus. If the syndrome is associated with edema of the eyelids and dilatation of the veins of the eyelids and forehead, and if fracture of the skull, orbital and periorbital infections and thrombosis of the cavernous sinuses can be excluded, the diagnosis is established."

Three patients have been encountered in which thrombosis had extended to other cranial sinuses, causing death in two. In one case recovery followed operation, and it is assumed that the superior longitudinal sinus was involved. Necropsy revealed the site of the extension in the patients who died.

REPORT OF CASES.

Case 1.—A woman, aged twenty-six, came to the clinic for examination December 7, 1920, because of severe headache and pain in the shoulder. She had had trouble with both ears since childhood. Four weeks before examination she had had a "cold in the head," followed by earache, which was more marked on the right. Discharge from the ears had afforded little, if any, relief from the headache. She had not been confined to bed. One day she had felt chilly. She had been markedly drowsy for several days, and then improved for a few days.

The canals of both ears were nearly occluded by fibromyxomatous polyps, which were partially removed to facilitate drainage. Tenderness was not demonstrated over the mastoid. The teeth were infected. The eyegrounds were normal. The blood showed secondary anemia; the leucocytes numbered 7,800; the examination of the urine and roentgenograms of the chest were negative. The patient was advised to enter the hospital for observation, because of the possibility of intracranial extension, but she refused. Five days later, she was worse, and a physician was called to her boarding house. She was in a stuporous, apathetic state, and complained of headache. She was taken to the hospital. The pulse was 60. The leucocytes numbered 9,800. The eyegrounds showed slight haziness of the discs. The neurologic examination suggested the possibility of abscess, but there were few positive signs. Examination of the spinal fluid was negative.

Exploration was performed December 18th, but abscess was not found. The evidence of pressure indicated encephalitis. The patient did not react well to the anesthetic, but continued to be drowsy and stuporous; the pulse was slow and full. The third day she was much clearer mentally, but her head ached severely, and her neck was rigid. Babinski's sign was positive; Kernig's sign was negative. The fifth day she was drowsy, but was aroused easily and appeared clear mentally. Her condition was not good. Little change had occurred on the seventh day. The tenth day the culture of the spinal fluid, which contained 32 cells, was positive. The temperature and pulse rose slowly. The eleventh day she suddenly became

worse; tonic convulsion occurred, followed by difficult respiration, cyanosis and death.

Necropsy revealed an organized thrombus in the right lateral and straight sinuses, hemorrhages into the right temporosphenoidal lobe on the side explored, and encephalitis.

Case 2.—A man, aged sixty-four, came for examination December 7, 1924, complaining of severe pain over the right side of the head. In July, 1924, he had had a sensation of fullness in the right ear, which was relieved by spontaneous rupture of the drum after a few hours. The discharge had been more or less continuous until the middle of October, when it suddenly stopped. Headache began to be very troublesome; it was rather sudden in onset and extended from the ear to the vertex and forward to the right eye. The pain was continuous, day and night, and interfered with sleep. Acetylsalicylic acid eased the pain but did not relieve it entirely.

Examination of the left ear was negative; the drum in the right was rather lusterless and full in the upper portion. The short process was not readily discernible. No mastoid tenderness was elicited. General examination, including blood counts, blood cultures and laboratory tests, was negative. Roentgenograms of the mastoids showed the right to be cloudy, as compared to the left, and a few air filled cells could be made out.

Surgical mastoiditis with probable parasinus abscess was diagnosed. Operation was advised but the patient returned home. When he was seen two weeks later the condition was found to be the same.

Operation was performed and nothing was found in the mastoid cells. When the sigmoid sinus was uncovered a parasinus abscess was encountered below the lower turn of the sigmoid. Opening the sinus revealed an organized obliterating thrombus. Bleeding was obtained from the bulb end, but none from the torcular end, although exploration was carried well toward the torcula so that a probe reached it definitely. Whether or not the straight or longitudinal sinuses were involved could not be determined, but probably it was the longitudinal sinus.

During the postoperative course the headache still remained an outstanding symptom and was not amenable to the usual methods of treatment. Vertigo was complained of on sudden

motion. Various muscle pains and chest pains developed. The patient was dismissed from observation January 26, 1925. During February symptoms strongly suggestive of pulmonary embolism or infarction developed. The convalescence was stormy and protracted for several months, but symptoms gradually disappeared, possibly as a result of canalization of the thrombus or establishment of compensatory circulation.

Case 3.—A woman, aged thirty-three, complained of severe left occipitoparietal headache, pain in the upper left teeth, weakness, chills and fever. There had been an acute infection of the upper respiratory tract in May, 1926, accompanied by severe generalized headache, worse behind the left ear, chills, low grade fever, nausea and vomiting. The symptoms gradually disappeared, but reappeared in June, together with severe earache. Myringotomy was performed, without relief, and was followed by little or no discharge. In August, 1926, a mastoid operation was performed, without relief from the headache. The pain would shift from the left to the right side of the head, and at times, for short intervals, it would disappear. It so happened that the patient was pregnant at the onset of the trouble, and after the birth of the child, July 9th, chills and fever appeared. Operation on the mastoid had been postponed because of pregnancy.

At the time of examination, October 6th, the patient was ill, and pale and pasty in appearance. She was somewhat drowsy but answered direct questions. Examination of the right ear was negative; the left drum was dull but intact. There was a mastoid scar with a fistula leading to the tympanic antrum and draining pus. No tenderness was noted. A few shot like lymph nodes were noted along the jugular vein. Hearing was normal. The pupils were equal and their reaction normal; there was hyperemia and edema of the discs, with elevation of about 1 diopter and slight dilatation of the veins. The fields were normal to rough test. The leucocytes numbered 8,200, of which neutrophiles constituted 79 per cent; the hemoglobin was 60 per cent. The blood Wassermann test was negative. The blood culture was negative after forty-eight hours. The temperature was 99°.

On the second day the patient was seized with a convulsive attack; the right arm jerked, she was unconscious for a few

moments, and then confused and delirious. She vomited several times and the headache increased in severity. Aphasia could not be definitely determined. Within twenty-four hours right sided weakness appeared, and convulsions and apparent aphasia continued. This all pointed to a lesion of the left temporal lobe. The temperature became higher (Fig. 1). The patient failed rapidly.

Sinus thrombosis with intracranial and intradural extension, even in the face of negative blood culture, seemed the most plausible explanation of the clinical picture. However, the intradural signs of involvement of the temporal lobe seemed the more important. The drowsiness, convulsions, severe headache and rapid failure could result from extension to other cranial sinuses, in which case operative interference was too formidable for the patient's condition.

Exploration of the left subtemporal region was negative. Rapid failure ensued and death occurred on the ninth day.

Necropsy revealed organized thrombosis of the sigmoid and lateral sinuses on the left, extending into the longitudinal sinus.

DISCUSSION.

The possibility of involvement of the cranial sinuses did not occur to me in the differential diagnosis in case 1, as all the usual signs of sinus thrombosis were lacking: there was no leucocytosis and no fever, and the blood culture was negative; but the symptoms and signs were strongly suggestive of encephalitis or early abscess of the brain, although localizing signs were lacking. The extension of the thrombosis from the lateral to the straight sinus may be explained on the basis of Dumont's classification.

The symptoms and findings common to all cases were organized thrombosis of the lateral sinus, severe headache, indefinite symptoms of intradural involvement, normal spinal fluid and blood count and negative blood culture. In cases 1 and 3, stupor, delirium and convulsive attacks were prominent symptoms, but the patients were in extremis.

The eye changes were not marked and not of diagnostic importance. In case 3 involvement of the straight sinus might have been expected, although the possibility of various types

of communication was realized. Whether or not there really was involvement of the other cranial sinuses in case 2 cannot be positively stated, but since bleeding could not be induced at the torcular end, since the symptoms were similar to those in the other cases, and since convalescence was protracted, I am led to suspect that the other sinuses were involved. Canalization of an organized thrombus must necessarily be a slow process and the protracted convalescence might be thus explained.

The pregnancy, which was nearly at term, interfered, no doubt, with the management of case 3, but the history of chills and fever, headaches and protracted course, under ordinary circumstances would have called for exploration of the sigmoid sinus, and life might thus have been saved.

Patients manifesting such untoward symptoms are too infrequently encountered for any method of surgical interference to have been devised. However, if another such patient is encountered, exploration of the longitudinal sinus may be undertaken. It would be a rather formidable procedure to approach the straight sinus. The decision to undertake such a hazardous operation would depend largely on the condition of the patient, although the condition itself is extremely dangerous. It is apparent that death is not attributable to sepsis but rather to change in venous circulation.

Unfortunately the type of the torcula herophili was not determined at the time of necropsy in cases 1 and 3.

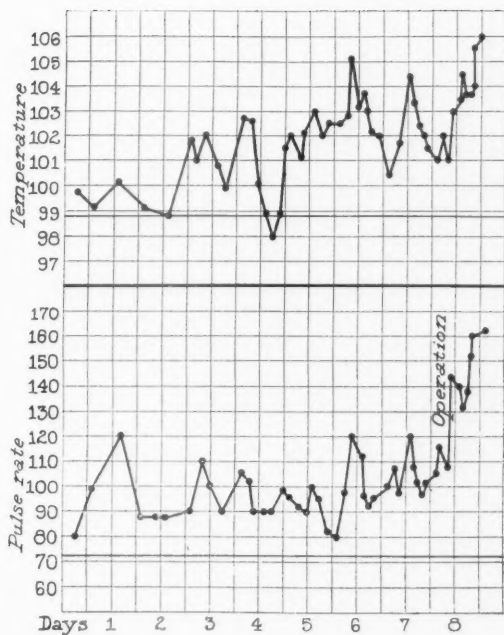


Fig. 1. Temperature and pulse rate in case 3 (thrombosis of sigmoid, lateral and longitudinal sinuses in extremis). Nothing characteristic or suggestive of this disease for three days. Meningitis suggested by terminal stage but not revealed at necropsy.

XXXIII.

MODERN FACILITIES IN THE DIAGNOSIS AND LOCALIZATION OF BRAIN LESIONS; THEIR IMPORTANCE TO THE OPHTHALMOLOGIST AND OTOLOGIST (LANTERN SLIDES).*

By E. R. CARPENTER, M. D.,

DALLAS.

I greatly appreciate the invitation of this society to discuss the important subject of brain lesions. Here local and general manifestations are of such a diversified character that they challenge the closest study of every man in the practice of medicine. I cannot offer you anything of a startling nature, but the unlimited opportunity for observation and new ideas in this field enable every earnest investigator to add something of interest to the general knowledge of all concerned. Remarkable strides have been made in this department of medicine and surgery during the last ten years. A few years ago at least 50 per cent of the serious chronic brain lesions were not understood clinically, while today a satisfactory working diagnosis and localization are possible in practically all cases, and at a much earlier period than formerly.

However, excluding the large medical centers, this progress is not yet appreciated by the profession. Every well known neurologist and brain surgeon will tell you the majority of patients referred to them from over the country come entirely too late to obtain the best results, and that many patients with brain lesions never receive proper diagnosis and localization. This situation arises from the facts that many patients with diseases of the brain recover, irrespective of the diagnosis, and that diagnosis and localization in chronic cases usually are impossible for those not well experienced in the work, and that many men attempt to do brain surgery who are not

*Read by invitation before the Chicago Laryngological and Otolological Society.

qualified in the diagnosis and localization of these lesions. In line with this thought, I wish to refer to a statement by James Briggs, Surgeon of the Royal College of Surgeons, London, who, in 1806, said: "It ought to be recollected that the term dexterity can scarcely be applied with propriety to surgical operations in the same sense in which it is employed in the mechanical arts; the success of an operation depending more upon a definite knowledge of what ought to be done than upon adroitness in the performance of it."

As a rule, patients with brain lesions consult their family physician, who, in turn, frequently refers them to the ophthalmologist and otolaryngologist for further investigation in regard to headaches and other cranial nerve disturbances. Only too often investigation ceases at this stage, and for months or years they receive symptomatic treatment for stomach disease, gallstones, appendicitis, sunstroke, epilepsy, endocrine disease, hysteria, mental impairment, tonsillitis, nasal disease, and other diseases that so frequently are confused with the symptoms arising from tumors of the brain, acquired hydrocephalus, and even abscess. Also obscure forms of encephalitis, meningitis, tuberculosis and syphilis contribute to the difficulty of diagnosis.

This situation will continue until the question of chronic headaches and irregularities in the nervous system receive the same thought and consideration that are now bestowed on persisting cough and all forms of pain and discomfort that develop in the abdomen and chest. At present a proper diagnosis is not made in 50 per cent of the chronic or recurring forms of headache, whereas, in at least 90 per cent of this trouble, a correct diagnosis is possible if properly investigated, and the majority of them can be relieved by some surgical means. More people lose their vision from optic nerve atrophy than from any other disturbance, and most of this blindness arises from unrecognized intracranial lesions that usually could be avoided by early recognition of the cause. Other cranial nerves are frequently involved without diagnosis being determined until quite late in development of the lesion. It is evident more careful attention should be directed to the early recognition of brain lesions than they usually receive, and

especially by those who teach ophthalmology and otolaryngology.

Brain tumors are a great factor in dealing with cranial disturbances. They are the most frequent of all regional tumors. Diagnosis of brain tumors is often difficult, and they require a thorough neurosurgical experience to determine the best course to pursue in treatment. He who understands brain tumors will have but little difficulty in the investigation of other brain lesions.

Notwithstanding the difficulties met with in this work, the assurance of improvement is when we realize and take advantage of the fact that 80 per cent of all patients with brain tumors have headaches as a primary symptom for an average time of two and one-half years antedating the usual recognized tumor symptoms of choked disc and optic nerve atrophy, paralysis and convulsions, deafness, or ataxia, incontinence, etc. Along with a better understanding of all forms of headache, various tests have been perfected for investigation of the brain, which, in connection with all other neurologic information, enable satisfactory diagnosis and localization to be made in at least 90 per cent of all tumor cases at a reasonably early period in development.

The most important tests in this work are quantitative perimetry, according to Walker and Cushing, the vestibular investigation, as perfected by Barany, and the replacement of cerebrospinal fluid by injection of air in connection with roentgen ray films, as developed by Dandy, Bingle and others. These tests are utilized by a limited number of investigators, but, as a rule, the extent of their usefulness is not appreciated. Quantitative perimetry and vestibular investigation can be done satisfactorily only by ophthalmologists and otolaryngologists who are thoroughly proficient in the work. Interpretation of the finding requires an intimate knowledge of brain anatomy and physiology; at times these tests are valuable in the localization of a lesion, and as positive or negative evidence as to the presence of a lesion within the cranial cavity.

Quantitative perimetry cannot be made with the usual office perimeter, as the distance and test objects are variable factors, but when made properly valuable information is often ob-

tained from this test that otherwise would be impossible. Very early indications of a lesion at the chiasm, in the optic tracts or in the visual centers may be evident, while distant lesions, with increased intracranial pressure, at times produce slight changes in the visual field that are important in diagnosis and localization.

The vestibular tests furnish valuable information in regard to lesions within the posterior cranial fossa; nerve trunks, the cerebellum, or the brain stem may be involved, with impairment of the vestibular function, while increased intracranial pressure frequently produces changes in the normal vestibular reaction. These tests always should be made before employing the lumbar puncture air test, which should not be done if the vestibular tests are abnormal. The Holmes optic nystagmus test is a valuable procedure in connection with the vestibular tests, as it furnishes information relative to the upper portion of the cerebrum, from the frontal to the occipital lobes, where the optic nystagmus centers and tracts are concerned.

Encephalography by the lumbar puncture method has been used many times by European investigators, and to a limited extent by Americans, but severe reactions, and occasional death, when made under local anesthesia, has restricted its use, while the trephine method, known as ventriculography, is used chiefly in the localization of brain tumors, abscess or hydrocephalus, in the late stages of development. A high mortality has accompanied the use of the ventricular method, but the danger is not so much in the gravity of the test as in the late stage at which it is now being employed. Either method of investigation reveals a remarkable insight as to the gross condition of the intracranium, but the gravity of the procedures interferes materially with their popularity. Some investigators consider them entirely too dangerous to be of practical value.

It is evident that the air tests would be of inestimable value if severe reactions could be avoided, and if the loss of life were minimized.

Personal investigation of many patients by the lumbar puncture method justifies the assertion that reactions seldom occur

and headaches are not very severe when the test is made under ether anesthesia and the patient is placed in a sitting position. There is practically no danger with it in normal conditions of the brain, and it is not a grave procedure in abnormal conditions, except where highly increased intracranial pressure from tumors, abscess and hydrocephalus is present. Increased pressure from other sources does not necessarily restrict its use.

The lumbar puncture test under ether anesthesia has been made many times in my office, sending the patients to their room while under the anesthesia. Frequently they have returned to their home, fifty to one hundred miles distant, the same or succeeding day of the test. Meningeal headaches may persist for three or four days, but they are controlled by the usual means, including opiates, if necessary. A "lumbar puncture headache" may occur independent of the meningeal irritation. The trephine method of encephalography is strictly a hospital procedure, and the danger is in proportion to the development of the disturbance and to the care exercised in making the test. Normal individuals are attended with a small amount of danger from intracranial hemorrhage, and considerable trauma occurs to the brain tissue at times, consequently, in my opinion, it should be used only where the lumbar puncture method is contraindicated, and in occasional cases to further clarify the findings where the lumbar puncture test has been made.

Highly satisfactory results have attended the use of these methods in the personal investigation of many patients where the diagnosis and localization could not be determined by other means. The lumbar puncture and trephine methods have been employed in numerous patients where headache was the only complaint, and where convulsions, petit mal or dream states were present, and to determine the cause of aphasia, paralysis, impaired vision and blindness, neuralgia, certain forms of mental disturbances, and in certain late traumatic conditions. When properly made under experienced judgment, these tests are no more hazardous than other useful procedures, like tonsillectomy and appendectomy.

The ratio of lumbar puncture methods to trephine methods has been about two to one; 50 per cent of the lumbar puncture tests have given negative findings; 13 per cent of the trephine

tests have given negative findings. One child, two years of age, with an extensive communicating type of hydrocephalus, died eleven days after the lumbar puncture test, but the air was not removed, as should have been done. Death, that might be attributed to the test, occurred in about 8 per cent of the patients where the trephine test was employed, but all these patients were in the terminal stages of brain tumor, and usually they were in a semiconscious condition or in coma at the time the test was made.

CONCLUSION.

1. A comprehensive understanding of chronic headaches and thorough investigation of cranial nerve disturbances at their incipency is essential to obtain the most satisfactory results in neurosurgical disturbances of the head.

2. More interest in this work on the part of ophthalmologists and otologists will accomplish much toward improving the situation.

3. The lumbar puncture and trephine methods of encephalography, as discussed in this paper, are the only known means whereby it is possible to arrive at a satisfactory working diagnosis in many patients suffering with chronic or recurring headaches and other obscure manifestations of brain disease. The discomfort and danger accompanying the use of these procedures, under proper judgment, is small, compared to the information gained in this otherwise hopeless class of patients.



Fig. 1. Injected cystic cavity following an abscess 18 years ago. "Status epilepticus." Complete recovery by puncture drainage of the cyst into the lateral ventricle.



Fig. 2. Separate injection of ventricles by trephine method. Hydrocephalus from tumor at foramen of Monro. Headaches and choked discs only symptoms present. Operation.



Fig. 3. Trephine method. Tumor in right temporal region. Head-aches and choked discs only symptoms present. Operation.

XXXIV.

POLYPOID TISSUE IN MAXILLARY ANTRA; X-RAY DIAGNOSIS.*

WILLIAM FRANCIS DREA, D. M. D.,

COLORADO SPRINGS.

The relationship-existing between chronic accessory nasal sinus infection and recurrent upper respiratory tract infections, as well as bronchitis, bronchiectasis and certain cases of asthma is prominent. The possibility of diseased paranasal sinuses acting as foci of infection in other conditions is also of importance.

Webb and Gilbert, in 1921, called attention to the necessity of X-raying the accessory nasal sinuses in all cases of chest disease where the sputum proved repeatedly negative to tubercle bacilli. They found that patients with nasal sinus disease were often without pain, nasal discharge or any sign suggesting nasal infection. They were able to confirm the statements of Rist and of Sergeant who, in 1916, called attention to the association of chronic bronchial cough with chronic disease of the paranasal sinuses.¹

The large number of patients in whom disease of the ethmoid cells and maxillary antra is shown to exist after careful clinical and X-ray examination has prompted the analysis of X-ray findings in a group of 694 consecutive X-ray examinations of the accessory nasal sinuses.

Frontal sinuses, ethmoid cells and maxillary antra only are considered, the sphenoid sinuses having been studied in too few cases to permit of any report.

Special attention is called to the number of cases where maxillary sinus pathology has been reported and to the possibility in this group to definitely diagnose by means of X-ray examination alone the existence in the antra of polypoid tissue.

*From the Colorado Foundation for Research in Tuberculosis, Colorado Springs, Colo.

Those cases operated upon have been reviewed and the surgical findings in the operated cases compared to the X-ray reports.

ANALYTIC REPORT OF X-RAY FINDINGS.

TABLE I.

Total number of patients X-rayed.....	694
Total number of patients reported having pathology in sinuses.....	358, or 51.5 per cent

The number of patients in whom the different sinuses were pathologic is as follows:

TABLE II.

Frontal sinuses.....	38, or 10.6% of the pathologic group
Ethmoid labyrinths	201, or 56.1% of the pathologic group
Antra	309, or 86.3% of the pathologic group

The following table has been drawn up to show the number of times each sinus has been involved and whether involved alone or with one or more other sinuses.

TABLE III.

Classification	Frontal		Ethmoids		Antra		Totals
	R.	L.	R.	L.	R.	L.	
1	+	57
2	+	53
3	+	+	44
4	+	+	+	+	63
5	+	+	+	+	+	+	22
6	+	+	+	+	+	2
7	+	+	+	+	+	1
8	+	+	+	11
9	+	+	+	1
10	+	+	+	2
11	+	+	+	+	1
12	+	+	+	3
13	+	+	+	1
14	+	+	12
15	+	+	15
16	+	+	+	11
17	+	+	3
18	+	+	+	5
19	+	+	+	+	2
20	+	1
21	+	11
22	+	9
23	+	+	25
24	+	+	+	+	2
25	+	+	+	1

Table IV indicates numerically the pathologic involvement of each sinus, regardless of complicating involvement of the other sinuses.

TABLE IV.

	Right	Left	Right and Left	Total Patients
Frontals	9	4	25	38
Ethmoids	43	26	132	201
Antra	84	77	148	309

By adding the totals of the figures in classifications Nos. 1, 2, 20, 21 and 22 of Table III, we find in this group single sinuses involved in 131 patients, a single antrum being involved in 110 patients, or 5.5 times as frequently as single ethmoid labyrinths. Single antra are involved 4.4 times as frequently as right and left ethmoids together, and if we add the number of patients where both antra were involved we find the antra involved about 6 times more frequently than right and left ethmoids alone. Patients with involvement of antra alone were 3.4 times more frequent than patients with ethmoid involvement alone. Frontal sinuses were relatively infrequently involved, and only one of this classification reported was not associated with other pathologic sinuses.

The foregoing is for the purpose of noting the predominance of antrum pathology in sinus infections. Table V shows the frequency in which it was possible to definitely state that evidence of polypoid tissue existed in the antra.

TABLE V.

	Right	Left	Right and Left	Total
Polypoid Tissue.....	48	46	54	148
Pathologic and Cloud- ing Only.....	55	50	75	180

The discrepancy between the figures for the total antra in Table IV and Table V exists because in the latter 19 patients are recorded twice, as 9 patients had a clouded right antrum and a polypoid appearance in the left antrum, and 10 patients had a clouded appearance of the left antrum and a polypoid appearance in the right antrum. In Table IV these 19 patients are listed under "Right and Left" heading, whereas in Table V the 19 patients are listed under "Right" and under "Left," and therefore have been counted twice.

METHOD OF X-RAY EXAMINATION.

Stereoscopic studies have been made in each one of these cases reported. Posteroanterior and lateral studies were made. Of these the more important is the posteroanterior, and the latter is that advocated by C. A. Waters. The antra are best demonstrated by this method, and at the same time a good outlining of the ethmoid labyrinth can be secured. It is also possible to differentiate the anterior ethmoid region from the posterior region. Further studies can be made if indicated of the ethmoid cells and sphenoid sinuses by employing the methods advocated by A. Granger, S. Iglauer and A. Phafler.

A technic as good as possible is employed, the secondary scattered radiation being kept at a minimum. It may be said in passing that the ability to diagnose pathology in the accessory nasal sinuses and to recognize polypoid tissue in the antra is naturally associated with the best technic possible. Stereoscopic studies must be made.

Frontal sinuses and ethmoid cells are reported as clear, slightly, moderately or densely clouded. It is seldom that polypoid tissue when present can be recognized as such in the ethmoid cells by X-ray studies. We have been able to do this in two cases confirmed by operation.

The antra can likewise be reported as clear, slightly, moderately or densely clouded. But in addition to the clouding that is recognized as being generally associated with pathology, it can often be definitely stated that polypoid tissue is present and the latter can be recognized as being alone responsible for the abnormal shadows.

The X-ray diagnosis of polypoid tissue in the antra is based upon the recognition of the surface boundaries of soft tissue shadows that have such spatial relations that they are definitely recognized as existing in the antra only. Only the stereoscopic examination gives these spatial relations and makes it possible to determine that the polypoid tissue shadows are in the antra. Shadows that may have the appearance on the single film of polypoid form in the antra can be projected from the base of the skull. A thick upper lip can likewise cast a shadow over

the antrum region, though this is usually easily recognized, even on the single film.

The amounts of polypoid tissue in the antra that can be recognized on X-ray films vary from what is little more than a thickening of the membrane on one of the walls, especially the outer wall, or a small amount over the floor, to masses that almost fill the whole antrum. Where the entire antrum is filled with polypoid tissue the antrum will cast a uniform semidense or dense shadow, and it will be impossible to state, from an X-ray examination alone, that the polypoid tissue is present unless some opaque substance is injected into the antrum. It is necessary, in order to make the diagnosis, that free surfaces of the polypoid masses be recognized if an opaque substance is not injected.

With a uniform abnormally clouded antrum and with the knowledge that the shadow is not due to an acute infection, and especially if washings return clear, it is quite probable that a polypoid condition exists. Especially is this true if there is a clinical history of recurrent acute infections in the antrum, though at the time of examination there is no acute infection. There is one condition, however, where this will not hold true, and that is where there are also present an unusually thick bony outer wall and floor. Here, however, both antra will be smaller than usual. Two of the incorrect X-ray reports of polypoid tissue made in the series operated upon were due to failure to keep this in mind.

Another condition where the antrum casts an abnormal shadow of uniform density, in the absence of acute infection, or when it may be free from any infection or polypoid condition, is after the antrum has had a radical operation some time previously. It is usual for such an antrum to cast an abnormal shadow, and it seems that the injection of an opaque substance or another exploration must be relied on for definite information in such cases if the antrum is under suspicion.

Any soft tissue in the antrum will cast a shadow similar to that cast by polypoid tissue, but in the group operated upon only a few patients with mucocoeles had evidenced such a shadow. It is possible to diagnose a mucocoele by recognizing that the

rounded free surface is very probably due to expansion by fluid from within the surface membrane.

That many acute antra casting uniform semidense or dense shadows have polypoid tissues complicating or causing the acute infections which many times are recurrent is illustrated by Fig. 6. Six weeks later the acute infection in the left antrum had subsided, and the uniformly dense shadow was replaced by the nearly normal shadow of the antrum. However, the free surface of polypoid tissue on the floor and outer wall could be recognized, as illustrated by Fig. 7. The latter was confirmed by operation.

Another observation is that polypoid tissue may develop in the antra after the clinical history of the case indicates that infection had been present. In one antrum it was obvious that infection had existed, because the patient was certain that a nose and throat specialist had washed out pus. Examination revealed no X-ray evidence of even beginning polypoid degeneration despite repeated X-ray investigations at the time. Polypoid tissue was reported in the ethmoid cells of the affected side and confirmed by operation. Four years later, the antrum was explored and considerable polypoid tissue found. A review of the films failed to show any indication of polypoid tissue four years earlier, and it seems reasonable to believe that the condition developed during the subsequent period and that an X-ray examination previous to the operation would have revealed it. The antra of another patient, negative for pathology four years ago, showed considerable polypoid tissue present in both at a recent X-ray examination. To demonstrate an increase in volume of polypoid tissue in a period of six weeks Figs. 6 and 7 of an operated and proved case should be consulted. More than twice the amount of polypoid tissue present at the first examination in the right antrum is indicated at the second examination. It would seem, therefore, that serial studies should be made where antra pathology is suspected and evidence is negative or indeterminate.

While the typical cases can be recognized without difficulty, it is necessary to be prepared to pass judgment upon a group that is frankly indeterminate or almost indeterminate. It is in this group that the most careful technic and repeated studies are necessary.

USE OF SUBSTANCES OPAQUE TO X-RAYS IN THE EXAMINATION
OF MAXILLARY ANTRA.

The above investigation is based only on the securing of X-ray films of the sinuses, no injection of foreign material opaque to X-rays, such as lipiodol, having been made. Reverchon and Worms and Fraser have reported the use of lipiodol in maxillary sinuses for the diagnosis of hyperplastic conditions. This method is undoubtedly of great value, but this paper is intended to show that diagnosis can be definitely made in a large number of cases without its aid. We think the greatest value of lipiodol studies will occur in an indeterminate group in which a diagnosis has been impossible without it.

At this time it is well to consider the underlying principle of all radiographs. Whether received on a fluorescent screen or on a sensitized photographic emulsion, they are shadow pictures. The absorption of X-rays is an atomic phenomenon, and the absorption does not depend upon the physical or chemical states of the substances absorbing. It is the number and kind of atoms present that is of importance, and not how they happen to be present, either all of one kind or in combination with others.

Bragg and Pierce's law for the absorption of X-rays is given by the relation $W_{at} = CN^4Y^3$ where W_{at} is the true absorption coefficient per atom, C is a constant, N equals the atomic number of the atom and Y equals the wave length of the X-ray. While the beam of X-rays is really a heterogeneous bundle, we consider it as a constant under the conditions we are discussing. In radiographing a skull, for example, we can consider the shadow effects as due to absorption of the X-rays by a very large number of different kinds of atoms, each atom absorbing a certain amount of radiant energy, the absorbing power of each atom varying as the 4th power of its atomic number. Briefly, then, we may state that the absorption varies as the 4th power of the atomic numbers of the atoms composing the absorbing substance and is also proportional to the actual numbers of each atom present.²

The human body is made up principally of the elements hydrogen, carbon, nitrogen, oxygen, phosphorus, and calcium, for which N the atomic number is 1, 6, 7, 8, 15, and 20, re-

spectively. The absorption of a compound, of a mixture, or of an aqueous solution is made up of the additive absorptions of the atomic constituents. For example, $\text{Ca}_3(\text{PO}_4)_2$, the principal absorbing factor in bone, is made up of 3 atoms of Ca, 2 of phosphorus and 8 of oxygen, while H_2O , the principal constituent of soft tissues, contains 2 atoms of hydrogen and 1 of oxygen in its molecule. The absorbing power of a molecule of $\text{Ca}_3(\text{PO}_4)_2$, compared to that of a molecule of water, will be as

$$\frac{3 \times 20^4 + 2 \times 15^4 + 8 \times 8^4}{2 \times 1^4 + 8^4} = 149.9$$

Thus one molecule of bone will absorb the same amount of radiation as will about 150 molecules of water, and we see why bone shadow is in sharp contrast to that of surrounding soft tissue.

If a piece of lead whose atomic number, N , is 82, is lodged in the bone, we see that its absorption must greatly exceed that of bone.

Barium, with its atomic number of 56, in the intestinal tract must cast a much denser shadow than that cast by the tissue about the tract.

Iodin, with its atomic number of 53, likewise must be more absorptive of X-rays than the body tissue elements. In other words, 1 iodine atom acts about as strongly as 1,926 atoms of oxygen. We are thus able to use the more refined results of physical research in the medical application of X-rays, especially those concerning the absorption laws.

Lipiodol then, because of its iodine atoms, will absorb more of the radiation than will the soft tissues of the polypoid structure and the bone through which the rays pass, and if the antrum is partly filled with polypoid tissue, a filling defect in the antrum shadow must result.

That lipiodol is harmless when injected into antra is shown by the reports of Fraser,³ and Reverchon and Worms.⁴ If the injection of the opaque substance is preceded by irrigation the presence of pus can be determined.

As shown in Table V, a larger group of cases was reported as being abnormally clouded than the group reported as defi-

nately containing polypoid tissue. Mithoefer⁵ stated that if the skiagram shows the antrum to be clouded and the nasal cavity filled with polypi, the diagnosis of hyperplastic maxillary sinusitis is almost assured, and he did not find an antrum without a large amount of hyperplastic tissue under such conditions. Mithoefer also calls attention to the flapping sound of polyp against the antral wall during lavage, and probing of the antral wall as aids to diagnosis.

FREQUENCY OF POLYPOID TISSUE IN ANTRA.

The purpose of this paper is to emphasize the importance of X-ray examination in determining the presence or absence of polypoid tissue in the antra. Rhinologists as a class are not aware of the frequency of such conditions, and some who are have denied the possibility of making a diagnosis from X-ray films alone. Lockard and Argall,⁶ who are aware of the frequency of antrum pathology and have called attention to it in their excellent paper, stated that after daily work for three years with routine X-ray examinations of the antra, "the roentgenogram cannot interpret for us the type of lesion, but it does generally show whether or not the sinus is normal." It is interesting that they should not have been able, with the large amount of work done, to definitely demonstrate the presence of polypoid tissue. As recorded in Table V, we were able to report 48 right, 46 left, and 54 bilateral antra containing polypoid tissue, as against 55 right, 50 left, and 75 bilateral antra with a pathologic clouding, out of the total group of 694 patients X-rayed.

THE ANTRA AS PRIMARY SITES OF PATHOLOGY.

Webb and Gilbert, as noted earlier, called attention to the frequency of antrum pathology associated with no evidence of nasal disease. Lockard and Argall stated that approximately 30 per cent of their nonacute cases were without local symptoms, either subjective or objective, and that 56 per cent of their 500 pathologic sinus patients had lesions of one or both antra, which were accompanied by no evidence of disease in the other sinuses. Mithoefer was convinced, after the study of a group of pathologic sinus cases, that in many instances the antrum is primarily involved with hyperplastic changes and

that a greater part of the polypi filling the nasal chambers are but an extension of the antrum hyperplasia which may have been present for many years.

Table III of the group being presented showed 57 right antra, 53 left antra, and 44 bilateral antra pathologic, with no X-ray evidence of pathology in the other sinuses, or 43 per cent of the 358 patients showing X-ray evidence of pathology in their paranasal sinuses had pathology in their antra only.

SURGICAL FINDINGS VERSUS X-RAY FINDINGS.

Of fifty-four patients who had radical antrum operations and 4 who had the antrum punctured, 18 had been reported as showing pathologic clouding and 40 had been reported as giving evidence of polypoid tissue.

Six patients of the "clouded" group had bilateral operations and the surgical findings were as follows:

No. of Patients	Surgical Findings
1	Considerable pus and polypoid tissue in both antra.
1	Considerable polypoid tissue in both antra.
1	Much polypoid tissue and much clear watery fluid in 1 antrum; much pus and degenerated membrane in the other antrum.
2	Much pus and degenerated membrane in both antra.
1	Thickened membrane without pus in 1 antrum and thickened membrane with pus in other antrum.

Eight patients in the "clouded" group had one antrum operated upon and the findings were as follows:

No. of Patients	Surgical Findings
3	Polypoid tissue and no pus.
3	Polypoid tissue and pus.
1	Thickened, degenerated lining membrane and no pus.
1	Thickened, degenerated lining membrane and pus.

Four patients of the "clouded" group had each a single antrum punctured and pus withdrawn from each.

Of the 40 patients operated upon reported as containing polypoid tissue from X-ray evidence, 19 patients had bilateral operations and polypoid tissue found in 18 of these in both antra. One patient thought to present X-ray evidence of polypoid tissue in both antra was proven to have both antra normal.

Twenty-one patients, reported as containing polypoid tissue in antra, had unilateral operations, and polypoid tissue was found in 20 antra, 1 antrum being found normal.

Of the 59 antra operated upon through the canine fossa with a previous X-ray report of polypoid tissue being present in them, 56 were found to contain polypoid tissue. The 2 patients that were erroneously diagnosed had very thick bony walls bounding the antra.

PATHOLOGIC REPORT.

Ryder⁷ has examined tissues removed at operation for hyperplastic conditions in the antra in many cases, including some of these, and has given the following description of polypoid tissues:

"Gross Appearance.—As received by the pathologist, polypoid tissue from the nose and accessory nasal sinuses varies considerably in appearance, being sometimes very abundant, soft and friable; sometimes more scanty, tough and stringy; and occasionally containing glairy material, varying from semifluid to an almost cartilaginous elasticity. The type of specimen most commonly received consists of a few cc. of rather soft gelatinous tissue, showing traces of lobulation, and in color pinkish, with variable amounts of dark blood."

"Microscopic Appearance.—The surface epithelium frequently shows some irregular erosion. How much of this is mechanical is difficult to determine. The glandular structures are likely to show hyperplasia, but this is rarely very excessive. The most uniform finding is an inflammatory edema in the propria and submucosa. The elements of this vary relative to one another. Sometimes the edema predominates, and the edematous tissue may have an appearance and staining reaction suggestive of mucoid tissue. Sometimes the cellular infiltration predominates and may be very dense. The most conspicuous cells are lymphocytes and eosinophiles. Polymorphonuclear neutrophils, large mononuclears and plasma cells are also frequent. Mast cells are occasionally seen. There is seldom any distinct evidence of tissue necrosis. The amount of vascularity is extremely variable. Thin walled, distended vessels are fairly frequent. The connective tissue is usually

distended to form a delicate reticulum; but in those cases which show a less abundant amount of tissue it may be dense."

"Bacteriology.—The organisms most commonly found are streptococci, pneumococci, staphylococci, micrococcus catarrhalis and Pfeiffer bacillus. Not infrequently it is impossible to recover any organisms, either in smear or in culture, from the chronic cases, and this may be true, even when the histologic picture is distinctly inflammatory."

At the request of the writer, Dr. Ryder also contributed the following statement, comparing the polypoid tissue of hyperplastic maxillary sinusitis with the tissue found in lymphoid hyperplasia:

"Polypoid Tissue Versus Lymphoid Hyperplasia.—As already noted, the most constant and striking characteristic of polypoid tissue microscopically is inflammatory edema. In lymphoid hyperplasia, on the contrary, the essential histologic feature is an increase in volume of the structural unit—i. e., the follicle—with or without an increase in the number of follicles above the number usually present in the lymphoid structure in question. The hyperplastic faucial or pharyngeal tonsil, as the pathologist sees it, may show considerable gross resemblance to polypoid tissue, though it is characteristically friable, where polypoid tissue is more characteristically elastic, because lymphoid tissue is cellular rather than fibrous or edematous. Microscopically, it is composed of follicles having, as a rule, very large 'germinal areas,' surrounded by zones of 'mature' lymphocytes, these zones being of variable thickness. The appearance of the germinal centers suggests rapid multiplication of cells, mitotic figures being rather frequent. The individual cells are vesicular, but the areas do not show distinct edema or infiltration with other inflammatory cells. Degenerated cells are sometimes seen. The remaining tissue outside the germinal areas may show patches of vascularization and scarring, and the epithelial covering of the lymphoid tissue may show erosion, and always shows some exudation of the lymphocytes, while lymphatics of the capsule or submucosa also contain many lymphocytes. But the essential picture in hyperplastic lymphoid tissue is of a multiplication of cells *in situ*, not an invasion of inflammatory cells from without nor a swelling due to increased fluid."

"It is possible that the same stimuli produce these different effects in mucous membranes and lymphoid tissue, respectively. Of these stimuli, bacteria are probably most important. As to what other factors operate, we have little knowledge."

SUMMARY.

1. Maxillary sinusitis is frequently associated with recurrent upper respiratory tract infections, chronic bronchitis, bronchiectasis and certain cases of asthma. Infection in maxillary sinuses may serve as foci of infection.

2. Out of a group of 694 patients subjected to X-ray examination of the frontal sinuses, ethmoid cells and antra 51.5 per cent presented evidence of pathology. Antrum pathology was reported to exist in 86.3 per cent of the pathologic group.

3. Antrum pathology was reported to be present with no evidence of pathology in the other sinuses examined in 154 patients, or 43 per cent of the pathologic group.

4. Of all the antra thought to be pathologic, about 45 per cent were reported as containing polypoid tissue after stereoscopic X-ray films had been studied and no opaque substance injected into the antra. Polypoid tissue, if present, may be recognized in the remainder of the pathologic antra by the injection of opaque substances, such as lipiodol.

5. Polypoid tissue may be present in the maxillary antra when all other evidence except that given by an X-ray examination is negative.

6. Surgical findings reported support the claim that polypoid tissue can be recognized in the antra by X-ray examination without the injection of opaque substances in a large group of patients.

7. An account is given of polypoid tissue as seen after operation by the pathologist, and a comparison made between polypoid tissue and lymphoid hyperplasia.

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Fig. 1. Reproduction of one film of stereoscopic pair exposed in Waters position. Polypoid tissue present in antra.



Fig. 2. Reproduction of other of stereoscopic pair exposed in Waters position. Polypoid tissue present in antra.

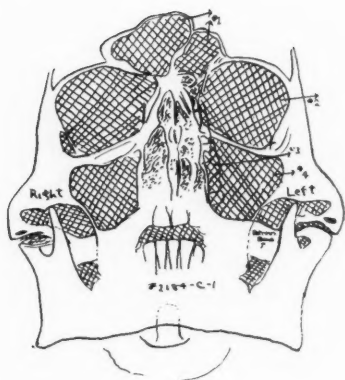


Fig. 3. Outline drawing to illustrate Fig. 1. No. 1 = frontal sinuses; No. 2 = orbit; No. 3 = ethmoid cells; No. 4 = antrum. Obliquely crossed lines represent normal shadows as seen in radiograph if Fig. 1 represented normal conditions.

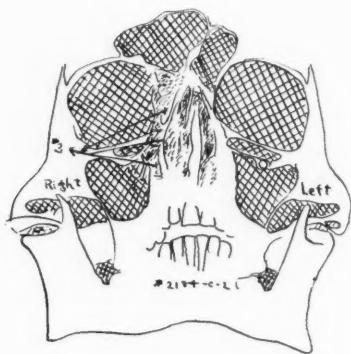


Fig. 4. Outline drawing to illustrate Fig. 2, if the sinuses were normal. No. 3 = ethmoid cells of side opposite to that shown in Fig. 3.

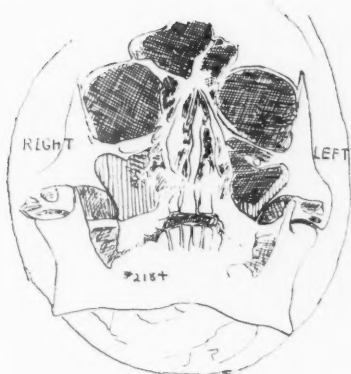


Fig. 5. Outline drawing to illustrate actual polypoid appearance in antra of X-ray films of Fig. 1 and Fig. 2. Vertical lines in antra represent polypoid tissue. Polypoid tissue found in antra at operation.

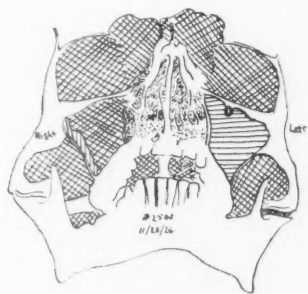


Fig. 6. Vertical lines at outer wall of right antrum represent polypoid tissue. Horizontal lines in left antrum represent densely clouded antrum due at this time of examination to acute infection.



Fig. 7. Same case as illustrated in Fig. 6, patient being X-rayed six weeks later. Note that polypoid tissue in right antrum has doubled in amount. Acute infection in left antrum subsided and relatively small amount of polypoid tissue at outer wall as indicated by vertical lines. Polypoid tissue found in antra at operation.

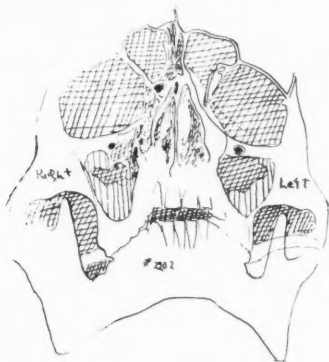


Fig. 8. Polypoid tissue in right antrum shown by vertical lines almost filling antrum, covering part of inner wall, the floor, outer wall, and part of roof. Left antrum contained polypoid tissue as indicated by vertical lines. Proved at operation.

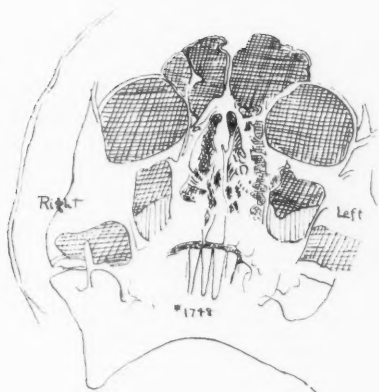


Fig. 9. Polypoid tissue present at operation as indicated by vertical lines in antra.

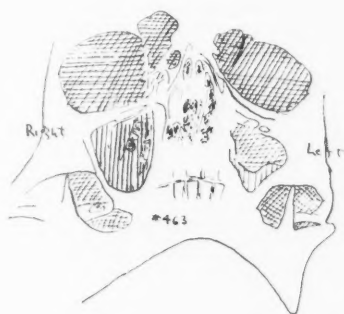


Fig. 10. Polypoid tissue present at operation as indicated by vertical lines in antra.



Fig. 11. Polypoid tissue present at operation as indicated by vertical lines in antra.

XXXV.

HERPES ZOSTER OTICUS.

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The acute infectious disease known variously as herpes zoster, zona, or more frequently to the laity as shingles, has come down to us from the ancients. Comments in old literature as well as its nomenclature lend to that thought, for the "Zoster" of the Greek signified a girdle, "Zona" or "Cingulum" of the Latin meant a belt or girdle, while an old French dialectic form, "Chengle," a girth, passed with its original meaning into the English "Shingles," which remains with us today as the popular name for this affection.

The name herpes zoster, as applied to herpes auris or herpes auriculae, is a misnomer from the standpoint of its usual significance, which is so well exemplified in intercostal herpes; however, it has gradually assumed its place as a proper name for the vesicular eruption of the cephalic extremity which is due to acute infection of the cranial ganglia having representation in this area.

FREQUENCY OF APPEARANCE.

Knowles found 286 cases of general herpes zoster among 31,337 patients with skin affections. Max Joseph, in his study of general herpes zoster, assigns to it the proportion of about 1 per cent of all skin diseases. Reports from various clinics at home and abroad vary between 1 and 2 per cent—a little more than 1 per cent, as in Knowles' records, being the rule.

Hewlett's statistics place 76 per cent of all cases of herpes zoster as affections of the trunk. Greenough's series indicate that herpes zoster of the intercostal nerves occurs fourteen times as frequently as facial herpes zoster. No records giving exact figures on this subject have come to notice, but if a mean is reached between the tabulations of these observers it is found, approximating roughly, that herpes zoster of the

cephalic extremity makes up from 8 to 15 per cent of all cases of this disease.

If this proportion is even relatively correct, its occurrence in this region is much more frequent than the number of such cases coming under observation of the otolaryngologist would suggest.

Personal inquiry reveals the apparent rarity of the affection in the practice of otologists, some of whom report the observance of a single case or, rarely, two or three, while very many have seen none. In comparison with other aural affections, case reports, discussions or studies of herpes zoster affecting the ear and contiguous parts are relatively infrequent in the literature.

Ramsay Hunt,¹ in 1907, in order to determine the relative frequency of the occurrence of herpes zoster oticus, examined the records of a number of hospitals with the following results: At the Manhattan Eye and Ear Hospital, covering a period of ten years and 47,600 cases, the diagnosis of herpes of the auricle was made twice. In the Brooklyn Eye and Ear Hospital, with a total of 15,000 cases in five years, the diagnosis was made once. The New York Eye and Ear Infirmary, with an average of 10,000 outpatients yearly, recorded this diagnosis six times. At the Massachusetts Eye and Ear Infirmary, in the preceding period of ten years, covering 65,000 patients, this diagnosis was made thirty-three times.

The same author,² in 1910, after an exhaustive search of the literature, reported a series of cases of herpes zoster of the cephalic extremity to the number of eighty-seven, twenty-seven of these being cases of pure herpes zoster oticus. In 1915, he³ gave out an additional series of twenty cases of herpes zoster oticus. This series represents probably the majority of all such cases reported to that date, and gives a fairly accurate idea of the relative frequency of diagnosed and reported cases.

The scope of this paper is not limited to herpes zoster oticus, but includes as well all cases in which any portion of the external ear is affected by the vesicular eruption of herpes zoster. This brings into the picture the sensory aural distribution of the Gasserian ganglion and of the upper cervical

ganglia, and thereby increases materially the number of cases which may be properly considered in the field of the otologist.

Vail⁴ in 1906, Dabney⁵ in 1914, Beck⁶ in 1914, J. E. Brown⁷ in 1917, F. P. Emerson,⁸ F. L. Dennis⁹ and J. A. Watson,¹⁰ within the past four years—all members of this society, or of the Triological—have reported cases and made valuable contributions to the literature of this subject. To J. Ramsey Hunt, however, belongs the honor of having placed herpes zoster of the cephalic extremity on the plane of a definite clinical entity. His monumental work in developing all phases of the subject is comparable to that of Head and Campbell in establishing the pathology of general herpes zoster.

NEUROLOGY.

Very brief mention will be made of the intricate and complex sensory innervation of the ear. The nerves taking part in this innervation are the fifth, seventh, eighth, ninth and tenth cranial nerves, and the great auricular and small occipital nerves from the cervical plexus.

The ganglionic representation of the ear is placed in the Gasserian, geniculate, petrous, jugular and the second and third cervical ganglia. The nerve supply of the auricle, external auditory meatus and canal, and the tympanic membrane have had many careful studies. Cushing's¹¹ study of the auricular fields of anesthesia after extirpation of the Gasserian ganglion and the upper cervical ganglia is outstanding in its completeness and thoroughness.

The accompanying illustrations, taken from his work, show clearly not only the sensory limitations on the external ear of the auriculotemporal branch of the fifth nerve anteriorly, and the great auricular and small occipital nerves posteriorly, but also a definite intervening area of esthesia between these anterior and posterior limits. Hunt, by the zosterian method of study as well as by association of related studies in comparative anatomy and embryology, has assigned neural representation of this area to the petrous, jugular and geniculate ganglia.

The very frequent association of a seventh nerve paralysis in this syndrome makes necessary mention of the accepted fact that the facial is a mixed nerve; the geniculate ganglion,

placed on the nerve just within the entrance of the aqueductus Fallopii, is homologous to the posterior root or sensory ganglia of the spinal nerves, and similar in type to the Gasserian, jugular and petrous ganglia, and there seems no doubt that all of these cranial ganglia are just as susceptible to the virus producing herpes zoster as are the spinal ganglia.

These ganglia have also an intraoral sensory representation, and a unilateral vesicular eruption affecting the tongue, fauces and pharynx has been noted alone as well as in association with auricular or facial herpes zoster.

PATHOLOGY.

The underlying pathology of herpes zoster was for a long period conjectural. The first to suggest that the eruption follows the distribution of the nerves was Mehlis, in 1818. In 1861, von Baresprung¹² reported the first autopsy, with findings in which he demonstrated clearly involvements of the posterior root ganglia.

Wyss, in 1871, and Sattler, in 1875, reported postmortem findings in a case of herpes zoster involving the ophthalmic or first division of the trigeminal nerve. In each case the Gasserian ganglion was found to be the seat of an inflammatory lesion. It was not, however, until 1900 that Head and Campbell¹³ gave out the results of their exhaustive clinical and pathologic study of herpes zoster, which included the pathologic material obtained from twenty-one autopsies, and placed this part of the subject on a substantial basis. These findings may be summarized briefly as a hemorrhagic inflammation of the posterior root ganglia, degeneration of the posterior root nerves and of the peripheral nerves as well as the root fibers in the posterior column of the spinal cord—secondary changes following according to the severity, extent and duration of the disease. The autopsies followed the onset of the affection from a few days to one and one-half years.

General herpes zoster affects usually a single ganglion, and the efflorescence is found along the cutaneous distribution of the corresponding peripheral nerve. Curious anomalies and variations from this rule have been observed; two or more ganglia may be affected at the same time, giving rise to a

corresponding extension of the herpetic zone. Although the infection is usually limited to one side, and this sharp delimitation is one of its strong diagnostic points, cases of bilateral involvement have been reported. This anomaly is still more unusual when the bilateral affection arises at different levels of the spinal segments. Unusual, also, is a homolateral involvement of widely separated ganglia, of which cases have been published.

The association of paralysis of the corresponding motor nerve in the areas covered by the spinal ganglia is rather rare; much less so is this the case in zoster of the cephalic extremity, where a seventh nerve palsy is rather frequent. Exceptional, indeed, is a facial paralysis complicating zoster of an intercostal nerve, but it has been observed.

ETIOLOGY.

The etiology of this disease has not been finally determined. Rivers and Tillett¹⁴ have made up a table suggesting a relationship between sheep-, horse- and cowpox, smallpox, varioloid, alastrim, chickenpox and herpes zoster, symptomatic herpes and epidemic encephalitis, all of which, except the latter, have in common a characteristic vesicular eruption of the skin, which shows similar histologic characteristics in most of them. A large literature on the similarity of herpes simplex, varicella and herpes zoster, and the probability of an identical etiology has been developed. More recently, epidemic encephalitis has been included in this group, on the ground of its origin from the same or a similar virus. In none of these conditions has the etiologic agent been isolated or cultivated, but the available evidence points to an ultramicroscopic or filterable virus as the causal factor.

Cole and Kuttner¹⁵ report as unsuccessful a series of experiments to inoculate rabbits, guinea pigs and monkeys from nine cases of herpes zoster. They discuss the experimental work of Teague and Goodpasture, Lipschutz, Kundratitz and a number of others, and conclude that until herpes zoster can be regularly transmitted to animals and cross immunity test carried out, the relation of the virus of herpes zoster to that of herpes simplex remains a matter of speculation, and it does not seem likely that the etiologic agents can be identical.

The question of the identity of herpes zoster and varicella is still more difficult to answer, because neither disease at present is easily transmissible to animals. Kundratitz's observations indicate a close immunologic relationship between herpes zoster and varicella, and seem to show the presence of a transmissible virus in the vesicles of herpes zoster. Thalhimer¹⁶ recently reported a fatal case of typical cervical herpes zoster, which at autopsy showed histologic findings in the central nervous system quite similar to epidemic encephalitis.

Aside from the specific agent which invades the neural ganglia, there must be other factors at work to induce or predispose to the disease. Some of these cases follow exposure to the elements, with chilling of the body, or appear after walking or driving in the face of a frigid wind. A number of cases follow or are associated with attacks of influenza. In others are found chronic nervous diseases, such as general paralysis or tabes. Head colds and sore throat are likewise mentioned as associated.

The association of head colds and influenzal attacks brings to mind the nasal sinuses and accessory cells, with the thought of their possible relationship. The possibility of the branches and endings of the peripheral nerves traversing the nasal mucosa and that of the paranasal cavities being concerned in the direct transmission of infection to the Gasserian ganglion has been suggested. With the same thought in mind, one may add the peripheral nerve distribution in the mucosa of the buccal, pharyngeal and laryngeal cavities, as possible conductors of an infective agent to the various ganglia having to do with herpes zoster of the cephalic extremity. Naturally, infective disease of the nasal cavities, tonsils or teeth must be considered as a possible factor in favoring the onset.

The presence of vesicular eruption, in so far as the writer knows, has not been demonstrated in the mucosa of the middle ear or of the paranasal cells; but in the buccal, pharyngeal and laryngeal cavities, herpes, strictly limited to the lateral half of these parts and conforming in other respects to cutaneous zoster, has been identified and recorded a number of times. One may recall Teague and Goodpasture's hypothesis, that the virus of herpes first multiplies at the site of inoculation

in the skin and passes up the corresponding spinal nerve to its spinal ganglion: the virus then seems to pass centrifugally along the nerve and its branches to the skin, where it multiplies rapidly and gives rise to characteristic herpetic vesicles. Should this hypothesis prove to be correct, it seems probable that in many cases transfer of the specific virus to one or more of the cranial ganglia may be along the nerve paths in the mucosa noted above.

SYMPTOMATOLOGY: PRODROMAL SYMPTOMS.

The attack may be ushered in by mild prodromal symptoms, with a feeling of malaise for a few days, followed by slight temperature and a feeling of general discomfort or aching; or the prodromata may be more severe, with a feeling of general illness and severe headache, succeeded sometimes by a violent chill with nausea and vomiting (case 2), or there may be no marked initial symptoms, the disease arising suddenly with or without a chill, violent pain being the first symptom to appear.

SENSORY SYMPTOMS.

If the geniculate ganglion is affected alone, or is the chief point of attack, the first symptom is usually a severe pain in the ear, lancinating, throbbing or deep aching in type. This preherpetic pain may reach a high degree of intensity, radiating perhaps to adjacent areas and prostrating the patient by its violence. If the upper cervical ganglia are chiefly affected, the first sensory symptom may be a sense of burning discomfort over the neck and occiput, which later develops into pain of the types noted above. Should the Gasserian ganglion be attacked, the same sequence may be noted on the face, or less frequently, perhaps, the last two types may have their sensory onset with characteristic pain. The pain usually gives way after the appearance of the eruption, but may persist as a postherpetic pain for many months, and this may take the form of a violent otalgia or mastoidalgia. Especially in the aged, sensory symptoms of burning, discomfort, pain or paresthesia may persist in the affected areas for many months or longer (in one of the author's cases still present after one and one-half years). These sensory symptoms may be more annoying at night, causing loss of sleep with its attendant ills.

Hypesthesia, or obtunded sensation, has been noted in the concha and external auditory meatus in recent cases of herpes zoster oticus with facial paralysis. In one of the author's patients, a case of facial and auricular herpes zoster with facial paralysis, a decided hypesthesia is still to be noted in the concha, external auditory meatus and near by points, after the lapse of one and one-half years.

At the onset of the disease, rarely has pain affected one side of the throat, giving rise to added discomfort and pain when swallowing, radiating then to the ear or to the mastoid or both. The reported cases developed herpetic eruptions over the intraoral distribution of the glossopharyngeal, vagus or facial nerves. Pain and soreness along the edge of the tongue have been noted rarely (case 1). It is to be noted that herpes zoster has affected the innervations mentioned above without giving pain.

THE VESICULAR ERUPTION AND ACCOMPANYING INFLAMMATORY REACTION.

Within a few days of the definite onset of the disease, a vesicular eruption appears. In the author's cases the eruption was preceded by a diffuse redness of the part and a definite infiltration or swelling of the underlying tissues, forming, so to speak, an inflammatory base upon which the vesicles arose. This has been recorded in the case of other patients, so that it is, no doubt, frequently the first objective sign to be noted. If the eruption is limited to the external ear alone, its distribution will be found in the zoster zones of the geniculate, petrous and jugular ganglia, which, as outlined by Hunt, occupy a cone shaped area from the posterior part of the tympanic membrane along the posterior wall of the external auditory meatus, include the concha, tragus, antitragus, incisura antitragica, antihelix and fossa of the antihelix, the upper part of the external surface of the lobule, and occasionally a small area on the posteromesial surface of the auricle and adjacent mastoid. If other parts of the auricle are affected, the Gasserian ganglion in part or the upper cervical ganglia or both must be affected, and a facial or occipitocollaric eruption alone or combined will be associated with the auricular efflorescence.

The vesicles may appear in small or large groups, scattered or almost confluent, and may occur in crops, a day or two or more between successive crops. In isolated herpes zoster oticus, there may be out two or three vesicles in the concha or in the external auditory meatus or rarely one or two or more have been observed on the tympanic membrane (Dabney's⁵ case). In other cases, a considerable number of vesicles appear in the zoster zone of the geniculate ganglion. These likewise may appear in successive crops. The skin of the ear may become red and swollen and the entire auricle take on an erysipelatous appearance.

In cases of the latter type the soft parts of the external auditory canal may become swollen, until it is difficult to examine the tympanic membrane and its landmarks. Should the vesicles be numerous and contain a considerable amount of serum, the rupture and drainage of several crops of these may, with other symptoms, give every indication of a middle ear inflammation which is draining through a spontaneous rupture of the tympanic membrane.

Usually, after a few days, the vesicles desiccate and the soft parts begin to lose their swelling and edema; in from two to four weeks the appearance of the ear is much the same as before, with the exception of remaining herpetic spots. These spots vary in appearance from small pigmented areas to cicatrices, which mark a healed ulcer in the deeper layers of the skin. Such postherpetic scars limited unilaterally, and to the peripheral distribution of a cutaneous nerve as well, may be sufficient evidence from which to elicit a history of the primary attack.

A small group of cases has been recorded in which an herpetic eruption was observed within the oral cavity. The vesicles in these cases were limited unilaterally as well as to a definite neural distribution, in contradistinction to the large number of cases in which vesicles of a different character are seen on bilateral areas of the buccal mucosa, and are not to be considered as manifestation of idiopathic herpes zoster.

This intraoral appearance has been noted on the tongue, the soft and hard palate, the uvula, the faucial pillars and ton-

sils, the pharynx, the epiglottis, the arytenoid cartilages and aryepiglottidean folds. The eruption in this type of case, appearing as it does upon mucous surfaces, is more evanescent, gives way more rapidly under heat and moisture of the mouth and leaves whitish or yellowish flecks, quite unlike our usual conception of a vesicular eruption (Hunt).

PARALYTIC COMPLICATIONS.

Facial paralysis complicating herpes zoster of the cephalic extremity is apparently very frequent, for Ramsey Hunt, in 1910,² reported a series of eighty-seven cases of zoster of this region, all of which were accompanied by seventh nerve palsy. In 1915,³ the same author refers to an additional group of cases of herpes zoster oticus, twenty in number, all of which had an associated paralysis of the facial nerve. This paralysis usually involves all three branches and is complete.

Since this nerve supplies all the facial muscles from the occipitalis to the platysma, the onset of paralysis with its cardinal symptoms of staring eye, flat face and twisted mouth, with lacrimal secretion overflowing and saliva dribbling from the angle of the mouth, is often quite alarming to the family, who feel, despite your assurance to the contrary, that it is the beginning of a stroke of paralysis. It is not unusual for the chorda tympani to show involvement by loss of the sense of taste in its distribution.

Paralysis of the soft palate, evidenced by drooping of the affected palatal arch and, on innervation, by elevation of the opposite arch and towards the nonaffected side, has been observed a number of times. That this palsy may result from inflammatory reaction in the glossopharyngeal or vagal ganglia has been suggested (Hunt). Laryngeal paralysis in the course of herpes zoster of the cephalic extremity has been observed (Dan Mackenzie¹⁷).

Rarely, paralysis of one of the motor nerves of the eye has been recorded as a complication of herpes zoster; out of Hunt's series of eighty-seven cases of herpes zoster of the cephalic extremity with paralysis of the facial nerve or auditory symptoms, but one case had an associated paralysis of a homolateral ocular nerve. Case No. 1, here recorded, is another of the same type.

One point of especial note is the evanescence of these palsies of the face, palate and larynx, and also of the cochlear and vestibular nerves, if we include them in paralytic complications. Frequently marked improvement in one or more or all of them may be observed within a week or two of the onset. Middle class cases, which entirely clear in the course of many months, are also to be found. Rarely either a partial or complete paralysis of the face is the final outcome. The limited duration of these palsies probably has somewhat to do with the less frequent observation and report of the palatal, and especially the laryngeal form.

HEARING.

The state of audition may vary from hyperacusis with various gradation to total deafness. Hearing may be affected through closure of the external canal by inflammatory reaction and swelling of the soft parts. In these cases Weber will lateralize to the affected side, unless a well marked perceptive deafness had been present in this ear, prior to the attack of zoster. Again, hearing may be dulled when desquamative debris has partly filled the canal. With its removal, the dullness will pass. Finally, one may by test uncover a diminution of hearing of perceptive type of which the patient was unaware; this will add to any difficulty in diagnosis.

These types are not of especial interest, save that they must be eliminated in diagnosis in this disease, but those where there is deafness due to specific inflammation of the ganglion of Corti are much more in question. In this type, the auditory acuity varies from hypacusis to total deafness. The frequent occurrence of auditory symptoms in herpes zoster of the cephalic extremity can be judged by the statistics of Hunt, who records twenty-six cases out of eighty-seven as presenting such symptoms in varying gradations.

VERTIGO AND DISTURBANCE OF EQUILIBRIUM.

These may or may not be associated with deafness. In a number of reported cases (Dennis⁹), the Meniere symptom complex of tinnitus, nausea and vomiting, deafness, vertigo and disturbance of equilibrium was an outstanding feature of the disease.

That these cases arise from an acute specific affection of the ganglia of Corti and Scarpa, there seems slight reason to doubt. No mention will be made of the clinical, anatomic and embryologic evidence or the studies in comparative anatomy utilized to buttress this theory, which has not as yet been confirmed by pathologic findings.

While deafness as well as vertigo usually passes away, it is in the type of case just mentioned that total deafness is most likely to be a permanent symptom. Vertigo and disturbance of equilibrium, even though severe, gradually pass as compensatory adjustment progresses. In several reported cases the cochlear and vestibular labyrinth have remained inexcitable to all stimuli, with resulting permanent deafness.

DIAGNOSIS.

Diagnosis today of herpes zoster of the auricle is perhaps not difficult when all the cardinal symptoms of a well marked case appear in sequence. But twenty years ago, when Vail wrote his thesis on this subject, he called attention in the first paragraph of his paper to the fact that among the various textbooks of otology he had consulted, but two, those of Dench and Burnett, gave a thorough description of the disease. The others either passed it by, or, if mentioned at all, discussed the subject in a paragraph not exceeding fifteen lines in length.

Naturally the undergraduate and postgraduate student of that time had slight opportunity of gaining even a reading acquaintance with the disease, and consequently there was a much greater possibility of overlooking a case, even though not particularly difficult of diagnosis. The status today is quite different, for recent textbooks contain cleancut descriptions of the disease. Furthermore, since Hunt's extensive work along this line, there have been occasional case reports and discussions in otologic journals (although as stated above, these are relatively infrequent), so that no one conversant with current literature need be without at least a slight acquaintance with the subject.

The history of a severe pain in the aural region, preceded by the prodromal symptoms mentioned, and followed shortly after by an inflammatory reaction and a vesicular eruption affecting the auricle, the external auditory meatus and canal

or tympanic membrane, this accompanied by, or a few days later associated with, a paralysis of the facial nerve of the same side, is pathognomonic of the disease. The same symptoms without the advent of seventh nerve palsy, but with the addition of auditory symptoms of either defect of hearing or vertigo and disturbance of equilibrium or both, is equally pathognomonic.

In such cleancut types it is improbable that an error in diagnosis will be made, even though the otolaryngologist has no other acquaintance with the disease than his reading of Dabney's⁵ critical essay of 1914, or that of Brown⁷ of 1917, or has taken note of Dennis'⁹ thoroughly reported case, with his discussion of the outstanding symptomatology of the disease, or finally, has come in contact with J. A. Watson's¹⁰ report of two cases with a presentation of some of the cardinal points of the disease. But many of the cases are much more difficult of diagnosis.

When the auricle remains swollen and crusts are to be seen here and there, giving at first glance the appearance of an acute eczema which has arisen as the result of an acute purulent otitis, and this fits in so well with other clinical symptoms, no little diagnostic skill is required to separate the two.

The various forms of myringitis must be considered, and especially those in which large vesicles or bullæ are found on the tympanic membrane and at times also on the wall of the external canal near by. These cases are found especially during or following an influenza attack, and are met with quite frequently. In comparison, herpes zoster oticus is rare, is very often accompanied by a facial paralysis, and, in one case out of three, by eighth nerve disturbances, while its vesicular distribution is seldom found on the tympanic membrane, but usually appears on the auricle (the central parts in particular), the external auditory meatus and at times the external canal, so that, as a rule, they will not be difficult to differentiate.

Dabney⁵ writes of how Bonnier faced a problem in diagnosis when he encountered a tuberculous syphilitic who exhibited ophthalmic and auricular herpes with vesicles along the temporoauricular distribution and six on the membrana tympani. In the light of the protean manifestations of lues, this picture would baffle many for a time, if not for all time. In

some of the cases, the symptoms closely simulate that of acute suppuration of the middle ear with associated mastoid pain and perhaps tenderness, or enlargement of the cervical glands. When we add to this paralysis of the cranial nerves, including the abducens (in one of the author's cases), despite the fact that the radiogram is negative, there may still be a suspicion that the disease is deeply seated in the cells of the petrous bone. In such a case, if the vesicular distribution had been small and had not been observed particularly by the family or the internist, it would seem hardly possible for the otologist to make a correct diagnosis, and that he would undertake surgical intervention in some form seems positive.

Kaufmann¹⁸ reports a case in which the diagnosis of acute mastoiditis was made and a mastoidectomy done, and Halphen¹⁹ describes a case that seemed to be one of grave mastoid disease, for it appeared to present acute otitis media, acute mastoiditis, deafness, and possible thrombosis of the lateral sinus, all due to the great mastoid pain, inflamed drum, swelling of the neck and facial palsy.

When confronted with cases presenting such serious symptoms and a cleancut history of a regional herpes zoster cannot be obtained, the radiogram will establish frequently the condition of the mastoid and its cellular spaces. An examination of the spinal fluid may also be of value, first in determining an increased pressure, and second as to its cell content. The blood picture in certain cases may give some points toward diagnosis.

From a study of the literature and an analysis of reported cases as well as those personally observed, the writer is led to believe that in many instances the tympanic membrane has been incised, and at other times mastoid surgery undertaken, in cases where this disease was not recognized; that mistakes in diagnosis may arise because many of these patients do not come under observation of an otolaryngologist, or because the essential elements for correct diagnosis could not be or were not elicited in the history and were not present for observation when the patient came under the care of an aural surgeon; that herpes zoster of the cephalic extremity is less rare than it seems, and that the prompt investigation of all the symptoms associated with the relatively numerous facial palsies would

place some of them at least as dependent upon affection of the geniculate ganglion by the specific virus of this disease.

CASE REPORTS.

Case 1.—March 4, 1925, N. P., 70 years of age, a stone mason by occupation, was referred to me by his physician with a diagnosis of acute mastoiditis, and with the suggestion of the necessity for immediate operation in view of the alarming symptoms he had exhibited for the preceding two weeks.

Mr. P. has always had rugged health, never having spent a day in bed on account of illness, to his recollection.

Four weeks ago, he had an attack of grippe with fever, aching and soreness in the bones and muscles, especially soreness and stiffness of the neck muscles on the right. He was confined to the house but not to his bed through this attack. Fifteen days ago he was taken with pain affecting the right side of his face, head, ear and mastoid, and radiating into the neck muscles. The same night, about 10 o'clock, he had a chill, and two hours later the pain through the areas noted became agonizing. The following morning, the right auricle was red and becoming swollen. At the same time, vesicles were noted on the face in front of and above the level of the ear. Two or three days later, vesicles appeared in the central parts of the auricle in the external auditory meatus. The same day another crop of vesicles appeared on the face in front of the ear and over the angle of the jaw. The auricle by this time was swollen and quite erysipelatous in appearance. Two or three days after their appearance the first vesicles had begun to desiccate, and two or three days later those within the cavity of the auricle and external auditory meatus ruptured and a sanguinous serum in small amounts came from this region.

About the same time that the vesicular eruption appeared within the auricle, the right side of his tongue became much inflamed and swollen, and was covered with vesicles limited strictly to the same side. The vesicles on the tongue healed about as rapidly as those on the face. There were no vesicles on the buccal mucosa, but his lips on their right side were much inflamed. Two weeks after the onset of the disease, paralysis of the right side of the face was noted, and at the same time an internal squint of the right eye was observed by the family.

There was no pain in the throat, or pain or soreness in swallowing food. Normal taste of food, however, was lacking.

With the onset of the vesicular eruption on the face and the coincident swelling of the auricle, he suffered from an intense vertigo and was unable to stand alone, falling to the right side. This vertigo has greatly decreased, but he still takes the arm of a companion in walking or places his hand against the wall or object of furniture when moving about the house unassisted.

His hearing was also affected, with the association of well marked tinnitus. His hearing has improved but he thinks it is still much below normal.

Examination: Temperature, pulse and respiration are normal.

A strong, vigorous looking man of 70, who has the appearance of having suffered extreme pain. The musculature in the distribution of the facial nerve and the motor branch of the trigeminal nerve on the left side is normal in action. On the right side, however, the face is flat and the forehead cannot be wrinkled, but there seems to be no impairment in the muscles of mastication.

Eyes.—There is a convergent squint of the right eye. The eyeball cannot be rotated lateralward beyond the midline, indicating a complete paralysis of the sixth nerve. Other external and internal nerves of the eye seem unaffected, and there is no disturbance of any of the ocular nerves on the left side. The pupils are 2 mm. in size, react to light, convergence and consensually. The vision with each eye with correcting lenses is 20/20 minus.

Nose.—The nasal cavities are negative.

Mouth.—The lips, the tongue, the mucosal covering, the fauces, uvula and pharynx are somewhat inflamed on the right side. All of his teeth have been extracted. The tongue protrudes straight. The tonsils are submerged but are of moderate size.

Ear.—The left ear shows nothing abnormal. The right auricle is still somewhat red and inflamed. The region of the concha and external meatus is covered with softened debris, which, when removed, has a slightly fetid odor. A desquamative dermatitis is present in the canal, which, when gently removed, leaves an inflamed base. The tympanic membrane

is covered by desquamating epithelium. There is no bulging, and the membrane and ossicles move readily with the pneumatic otoscope. No evidence of perforation of the tympanic membrane is seen.

✓ Hearing: Left ear equals conversational voice, 40 ft. plus; ✓ whisper, 9 inches. Right ear equals conversational voice, 40 ft.; whisper, 6 inches.

Station: With eyes closed, sways markedly to the right and finally falls. Direction of falling varies with change of position of the head.

Gait: With eyes closed, walks to the right and falls if not supported. Patellar reflexes present.

Three weeks later the patient's symptoms were somewhat improved. Within three months he was able to open and close the right eye perfectly, the ocular rotations were normal in the field of the paralyzed muscle, and movement of the face had much improved.

After six months, he had no symptoms that gave him real trouble, except paresthesia, soreness and pain in the facial region which the vesicular eruption had affected, and also a sensation of burning along the right side of the tongue and of the lips. Following the appearance of the facial paralysis the pain in the ear had lessened rapidly, and at this time simply an occasional pain in the ear and mastoid were noted.

A recent examination of this patient shows a strong, rugged looking man, 72 years of age, the forehead wrinkled and the eyelids open and close normally. He is just regaining the power to whistle for his dog. Sensation is the same on both sides of the face. He protrudes the tongue straight and sensation is the same on both sides. There is no sign of muscular weakness in the palatal musculature.

Eyes: Pupils are small, 2 mm., react to light, convergence and consensually. Vision with correcting lenses is a little less than 20/20 minus in each eye.

Ears: Show nothing abnormal. The hearing for whisper is three inches for right ear and nine inches for the left ear, with Weber lateralizing to the right. Sensation to touch in the concha and auditory canal of the right ear is decidedly obtunded. His station is good and reflexes active.

He states that paresthesia, soreness and pain in the face is as severe as ever, and so extremely annoying at night as to seriously disturb his sleep. He mentions, also, occasional pains in the ear and mastoid, which are neither frequent nor severe.

This case is of unusual interest for several reasons:

1. The coincident involvement in sequence of six cranial nerves, from the fifth to the tenth, with ganglionic relation to the Gasserian, geniculate, auditory, petrous and jugular ganglia. This illustrates admirably the multiple involvement of ganglia in herpes zoster of the cephalic extremity.

2. The association of an intraoral herpetic affection, zosterian in type, of which but few cases have been recorded.

3. The presence of a sixth nerve paralysis complicating herpes zoster of the face, ear and tongue. Abducens paralysis has been reported a few times in association with herpes zoster ophthalmicus; but Hunt, in an exhaustive search of the literature, found but one case of herpes zoster of the cephalic extremity complicated by facial palsy and auditory symptoms with which an ocular nerve paralysis was combined, and in this case the sixth nerve was affected.

The causal factors influencing this sixth nerve palsy cannot be determined, but in attempting to account for its presence one may discuss certain features. It is, of course, peripheral in character—that is to say, an affection of the nerve fibers at some point between the nucleus and the ending of the nerve in the external rectus muscle. Affection of the nerve at any point within the orbit seems improbable, for the reason that sixth nerve palsy is recorded so rarely in herpes zoster ophthalmicus, in which the tissues about the orbit are always affected, and even the globe and other intraorbital tissues frequently may be. That this is the result of pressure from an increased volume of cerebrospinal fluid (this increase seems not uncommon) also seems unlikely, for the acute period of the disease had passed before the palsy appeared, and there were no other symptoms of such pressure. That it was a toxic paralysis in the correct meaning of the term, such as may occur in diphtheria, for example, is not probable, for the infective agent inducing herpes zoster has a selective affinity for the unipolar cells of the sensory ganglia and not for the nerve primarily.

Aynaud's²⁰ case of abducens palsy complicating facial and auricular herpes zoster with facial paralysis and auditory symptoms (cited by Hunt) is the only one noted by the writer in a review of the literature. This case had an associated intra-oral herpes as had the case under discussion. The fact that both of these cases had an herpetic involvement of the mucosa within the oral and pharyngeal cavities leads to the thought that concurrently a vesicular inflammation affecting the mucous membrane of the sphenoid sinus and ethmoid cells may have developed.

The work of Sluder and Onodi²¹ has shown how frequently the sphenoid cavity is of large size, with its walls thin as paper and presenting dehiscences; their work has shown also the frequency of an intimate relationship between the sixth nerve and the contiguous sphenoid wall. An affection of this nerve from inflammatory reaction within the sphenoid sinus is on record.

That the pathology outlined was causal in the production of the abducens paralysis in both of these cases seems not only possible but more likely than the other methods discussed, and is here suggested as the probable cause in the author's case.

Case 2.—Miss E. L., P. M. H., has had the usual diseases of children but no serious disease of adult life. Her health has usually been fairly good, and she passed through the three years of nurse's training without difficulty. April last, she had a slight attack of hyperthyroidism; this was of short duration, and since then she has been perfectly well, although during the week of July 4th she had at times a hemiopia of the right visual field lasting for a few minutes.

July 15th, she developed an intense pain in the top of the head, through the forehead and into the eyes. The next morning the headache was gone, but her head was sore and the eyes particularly sore on movement. On the following day she returned home fearing the onset of an acute illness.

July 18th, she felt rather ill and toward evening went to bed; shortly afterward she had an intense chill lasting for ten or fifteen minutes. Chilly sensations persisted at intervals for several days, intense nausea with vomiting following the chill.

July 19th, she felt better but had a temperature of 102, so

returned to bed and remained for the greater part of two weeks. Her temperature persisted for eight days, returning to normal on the ninth.

During the nineteenth, there was a feeling of paresthesia and burning discomfort over the right neck, an inflamed and reddened surface appearing in this region. The following day a vesicular eruption appeared in the right supra- and infra-clavicular regions, and posteriorly from the deltoid region to the midline of the neck.

After a second interval of two days, the right auricle became inflamed and swollen, and vesicles appeared on the helix from the root over a considerable part of its extent. There were a few small vesicles in the concha, on the anti-tragus, in the incisura intertragica, and on the outer surface of the lobe of the ear. There were also a few vesicles scattered over the mastoid, and a small group appeared on the postero-mesial surface of the auricle and adjacent mastoid, corresponding to the distribution of the vagus in that region. There were no vesicles in the external canal or on the tympanic membrane.

Coincident with the eruption on the ear vesicles appeared over the face as high as the inferior distribution of the auriculo-temporal nerve. All of the vesicles on the face, the mastoid and the auricle were much smaller than those of the occipitocollaric region.

The photograph of this case was made one week after the appearance of the eruption, when it was already regressing markedly over the aural and facial regions.

It has been noted before that the eruption on the neck was preceded by a feeling of burning discomfort and paresthesia. This was true likewise of the face and ear. However, in both cases these sensory symptoms changed to soreness and then pain of the lancinating character, which was at times excruciating. The pain of the ear was limited largely to its depths, and this pain and that in the mastoid were the last to make their appearance. With the onset of the eruption the pain lessened materially, although two weeks later there were not infrequent pains in the occipital region and over the shoulder (these pains had extended originally down the right arm to the

wrist). At that time she had also had occasional ear pains but not of great severity.

The acuity of hearing was somewhat lessened. There has been also some feeling of dizziness, especially upon sitting up in bed, when she has a sensation of falling to the left and falls unless supported. This feeling is also present when she turns from one side to the other. The sense of taste has been disturbed, first in a partial loss of taste, and second in that there is a constant metallic taste in the mouth, somewhat similar to that of iodine.

Examination: A well nourished young woman; the facial muscles normally active on both sides. The eyes are negative. On the right side of the face, external ear, mastoid, neck, supra- and infra-clavicular and the suprascapular regions a vesicular eruption of herpes zoster, as described above, is present.

Hearing: A test for voice and watch gave the following: Right ear, whisper at 12 ft. and watch at 1 ft.; left ear, whisper at 40 ft. and watch at 4 ft. Weber indifferent.

Vertigo and equilibrium: Standing with eyes closed, sways to the left. Walking with eyes closed, walks to the left.

Mouth: There is no inflammatory reaction in the mouth or pharynx, but there is a slight drooping of the right palatal arch; on innervation, the left arch is more active in its response. Taste has already been noted. The symptoms narrated above passed away gradually. Within a few weeks the vesicles and crusts disappeared; hearing returned to normal; vertigo cleared and the sense of taste returned.

Five months after the onset of the attack the only symptom left was a feeling of soreness or tenderness about the neck and shoulder and a few scars in this region.

Comment: In this case the chief point of attack was in the third and fourth cervical ganglia, the occipitocollary eruption corresponding closely to Head's segmental outlines. The severe pains along the nerves of the brachial plexus, although no affection of the skin was in evidence, indicates at least a mild affection in that direction.

The vesicular eruption on the face, ear and mastoid, less marked than that of the neck, points to a shading off in the severity of the infection from the second cervical to the Gas-

serian ganglion. Loss of the normal with perversion of the sense of taste, the presence of definite although mild auditory symptoms, a paresis of the homolateral arch of the palate, as well as the presence of vesicles in the peripheral zones of the auriculotemporal, facial (geniculate ganglion), and auricular branch of the vagus nerves, combine to make plausible the thought of infection of the entire chain of sensory cranial ganglia having to do with innervation of the parts mentioned.

Case 3.—Mrs. M. B., age 50, occupation, housewife. May 14 she was referred by Dr. O. C. Mierly, on account of left facial paralysis and eruption of the left auricle.

P. M. H.: The patient had the usual diseases of childhood except diphtheria and scarlet fever, and has had no serious illness since then. Her appetite is usually good; she sleeps and rests well and has always been muscularly active.

H. P. I.: On May 3rd (eleven days ago), a pain of severe type affected the left side of the face, mastoid, neck and shoulder. This became more severe until May 4th (eight days ago), when an eruption appeared on the auricle. The following day a complete paralysis of the left side of the face appeared. At the same time the mouth became dry and a bitter taste was noted. The pain became less severe after the onset of the palsy and has gradually disappeared until today, when an occasional twinge affects the face and mastoid. Hearing of the left ear was much lowered in the first few days of the attack, and dizziness of mild degree was noted. The hearing today is better, and there has been no dizziness for three or four days. Slight improvement of the facial paralysis is noted, although dryness of the oral cavity and bitterness of taste persist unchanged.

Examination: Very well nourished woman. Facial muscles normally active on the right side but parietic on the left. On forced closure of the eyes, the left lids can be closed about one-half. The angle of the mouth falls slightly on the left, and she cannot show her teeth or smile on that side. Sensation is normal on both sides.

Eyes: Pupils 3 mm., react freely and equally to light and convergence and consensually; ocular rotations normal; no gross lesions of the fundi; epiphora present left side.

Nose: Septal deflection to left; no inflammatory reaction to be seen.

Mouth: Tongue protrudes to left, though she can at command push it to the right. Taste is normal for sweet, acid and bitter. Upper teeth removed, lower teeth in very bad condition. Anterior faucial pillars chronically inflamed; liquid pus can be expressed from both tonsils, which are submerged. Musculature of palate and pharynx normally active.

Ears: Right ear, normal findings; left ear, auricle reddened and somewhat swollen; small vesicles in various stages are seen on the helix and the central parts of the auricle, the external auditory meatus, the antitragus, incisura intertragica, and a few in front of the lobule; the external canal is reddened and inflamed but no vesicles or erosions are seen; the tympanic membrane is unaffected, landmarks cleancut and the long process of the anvil can be seen.

Hearing: Right ear, good for conversational voice, whisper, high and low forks. Left ear, high forks shortened; whisper 0; with Barany noise apparatus in right ear, left ear hears conversational voice at ten feet. Weber to the right.

June 8th. Facial movement has improved very much; left eye can be completely closed, although some epiphora remains; dryness of mouth and bitter taste much lessened; eruption and swelling of auricle cleared. All of her lower teeth were extracted the week of May 17th. She refuses to have her tonsils removed.

Seven months after onset of the disease all symptoms had cleared except for a very slight paresis of the left face and a sensation of itching and burning, at times affecting the central part of the left auricle.

In arranging cases of this nature according to their varying types, Hunt² has given the following classification:

I. The syndrome and its clinical types.

- A. Herpes oticus.
- B. Herpes oticus with facial palsy.
- C. Herpes oticus with facial palsy and hypoacusis.
- D. Herpes oticus with facial palsy and Meniere's complex.

II. Subgroups of the syndrome.

Herpes facialis with facial palsy and auditory symptoms.

Herpes occipitocollaris with facial palsy and acoustic symptoms.

Herpes zoster of the cephalic extremity, with auditory nerve complications.

Following this arrangement, Case 3 would be classed in group I under the clinical type C. Case I would appear under group II, clinical type 1, herpes facialis with facial palsy and auditory symptoms, but with the addition of herpes auriculæ and herpes linguæ.

Case 2 is one of herpes facialis, auricularis et occipitocollaris with auditory symptoms.

Of the three cases the only one to come under cleancut classification is case 3, cases 1 and 2 not coming distinctly under any one of the subgroups.

It is of interest to note that two of the three cases presented a complete paralysis of the facial nerve. This aids in confirming the fact that seventh nerve palsy is very commonly associated with herpes zoster oticus or herpes zoster of the cephalic extremity.

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Photograph taken one week after the appearance of the eruption of the ear. The vesicles have desiccated and are disappearing rapidly, although small herpetic spots can still be seen in the concha, on the antitragus and lobule. The swollen appearance of the helix, with drying crusts and small vesicles, can be noted. The suprascapular eruption, with the sharp delimitation of vesicular process at the midline of the nuchal region, is well shown.



In this view is brought out especially the sharp delimitation of the vesicular process at the midline of the chest and neck. On the mastoid can be seen drying crusts and vesicles, and these extended to the posteromesial surface of the auricle and adjacent mastoid, the area supplied by the auricular branch of the vagus and the facial nerves. The occipitocollaric eruption, with its sharp unilateral limitation at the midline anteriorly and posteriorly, is of itself diagnostic.

XXXVI.

RECENT VACCINE THERAPY IN OTOLARYNGOLOGY.*

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An examination of developments in serum and vaccine therapy since the terrible respiratory pandemic of 1918 will disclose much of interest to the laryngologist, without leading us far afield into the unfamiliar vocabulary and the arduous reasoning of the immunologist and the biochemist. Twenty years of intensive work under the principles established by Ehrlich and Bordet have brought some changes into the original dicta of Pasteur. Sir Almroth Wright has recently amended them as follows:¹

"1. The essential preliminary to all immunization procedures is to possess ourselves of the microbe of the disease, or, failing that, of its virus, and to employ this as material for the manufacture of the vaccine. And here it may be parenthetically pointed out that inasmuch as in prophylactic vaccination the vaccines are stock vaccines and give good results it cannot in any form of inoculation be theoretically essential to employ vaccines made directly from the patient.

"2. Vaccines should in all cases, where the microbe can be cultivated outside the body, consist of sterilized cultures.

"3. Vaccines may be turned to account in a variety of different ways. They may be employed not only for prophylaxis but also for preventive treatment in the incubation period of general infections. Again, they may be therapeutically employed in all localized infections other than those complicated by pyrexia and heavy and frequent autoinoculations. In this last class of infections, and also in those septicemic processes in which bacterial toxins in large quantity are circulating in the blood, vaccines are contraindicated.

*Read, by invitation, before the Philadelphia Laryngological Society, January 11, 1927.

"4. Bacterial vaccines should be incorporated hypodermatically.

"5. The quantum of vaccine incorporated is of supreme importance: it affects the kind of response and the rate at which protective substances appear. With only small doses of vaccine or comparatively light autoinoculations, a positive phase—or, as it may be better called, an epiphyllactic or immunizing effect—may be registered in less than twenty-four hours after the incorporation of the vaccine. A similar but evanescent rise, known as the false rise, may be registered within a couple of hours after larger doses of vaccine and heavier autoinoculations. These larger inoculations of vaccine and heavier autoinoculations produce after that very fleeting positive phase a negative phase, or—for these are better terms—an apophyllactic or deimmunizing effect. And this effect is greater and lasts longer the larger the quantity of antigen carried into the blood.

"6. In correspondence with the above the following rules of dosage may be laid down: In prophylactic operations undertaken in uninfected surroundings the dose should be that which evokes the optimum epiphyllactic response, and it is for the attainment of that end permissible to employ doses which produce a temporary negative phase. When inoculating prophylactically in the presence of an epidemic, or in the incubation period of a general infection, and generally in the treatment of localized infections, reduced doses should be employed in order to avoid the constitutional disturbance and temporary aggravation of symptoms and dispersal of microbes in the organism. Reduced doses should also be employed where the chief matter of concern is to obtain with promptitude some clinical improvement.

"7. The antibacterial substances elaborated in response to inoculation operate specifically upon the variety of microbe which has furnished the vaccine, but it is possible that in addition some collateral immunization is achieved."

These accepted principles have been quoted exactly because they must afford us the basis for any critical analysis of such procedures as have recently found proponents in our own field.

We shall not make any detailed discussion of antitoxins and

serum therapy, although recent results in combating poliomyelitis by immune sera and convalescent spinal fluid are suggestive of possibilities in our field. Accurate typing is, of course, imperative in the employment either of convalescent serum or of that from a well person who has been immunized by a heavy dosage of the bacterial toxin in question. When invasion of the cranial cavity occurs from the ear or accessory sinuses, especially if the basal ganglia or the ventricles be threatened and surgery is inadequate, these serologic methods may find application.

Bacterial vaccines, according to Wright,² are "sterilized and enumerated suspensions of bacteria which furnish, when they dissolve in the body, substances which stimulate the healthy tissues to a production of specific bacteriotropic substances which fasten upon and directly or indirectly contribute to the destruction of the corresponding bacteria."

The term "bacterin" has been suggested in place of "bacterial vaccine," but custom has sanctioned the latter, while "bacterin" has come to be regarded as a term peculiar to tuberculosis therapy.

The number of killed organisms to each cubic centimeter of vaccine varies with different workers, between five hundred million and two billion. We have preferred the higher concentration for our work with staphylococci and streptococci, since we are thus enabled to keep down the size of the individual dose.

Vaccines must be carefully sterilized, lest deterioration of antigens occur from too much heat. They must be kept in the cold, and should be used promptly after their preparation, because active immunizing effects diminish decidedly when the vaccine is more than a month old. During the administration of a vaccine, this gradual loss of immunizing power in the vaccine may be due to the corresponding rise in immunity in the patient, with gradual disappearance of the microbe in question from his local flora; and perhaps also to outgrowth of other species. Renewed culture to disclose these facts is, therefore, indicated after four to six weeks of vaccine administration, especially if pathologic manifestations continue.

The so-called bacteriophage, first noticed by Twort,³ in 1915, as a byproduct of cowpox vaccine, which had the power of

dissolving and killing living colonies of staphylococci, was worked out by d'Herelle from 1917 to 1921, mainly upon various enteric organisms. This filter passing bacteriolytic agent seems to lack specificity and may attack various kinds of bacteria.⁴ D'Herelle considers it to be an ultramicroscopic organism which produces some sort of digestive ferment fatal to bacteria. Possibly these ferments may be present as by-products of bacterial growth per se under certain cultural conditions, without the necessity for any hypothetical filter passing organisms.

Hemolysis, the solution or injury of red blood corpuscles with liberation of hemoglobin, is obviously a very important process to the living individual. Destruction of the oxygen carrying power of the blood, with resultant lowering of resistance to bacterial invasion, is evident through the various clinical signs of secondary anemia. Effects of pure hemolysis, divorced from microbic or other toxic elements, may be studied by the intravenous injection of triple distilled water. In small amounts, this disequilibrium of the fluid content of the blood produces an immediate protective response, which is shown in slight fever and marked leucocytosis, with distinct buoying up of the vital processes for a day or two afterward. Large injections, however, destroy so many corpuscles as to produce serious hemoglobinuria, high fever and death.

For our purpose, bacterial hemolysis will alone be considered. Obviously, microbic toxins which produce hemolysis are more likely to be virulent and harmful to the human economy than those not hemolytic.⁵ Hemolysins are filterable substances "produced in quantities roughly proportionate to the virulence of the particular microorganism."⁶ Sanguineous exudates, particularly streptococcic; petechial hemorrhages; severe secondary anemia, with destruction not only of red but also of white cells are all consequent upon the entrance of these soluble poisons into the human economy. Whether or not we go as far as Rosenow in accepting the doctrine of the "tissue specificity" of various microbic strains, we must admit that much evidence supports the view that certain organisms may develop selective affinity for neural tissue, and others for various visceral, synovial or glandular cells. But an almost equally strong group of observations supports the idea that such tropisms

of parasitic growth may change with variations in an individual's resistance. Given a low hemoglobin percentage, a low red cell count, the individual is an easy prey to invaders of many sorts; increase his resistance by vitamin feeding, by sunlight or the quartz lamp, by transfusion, by intravenous iron, and certain toxic microorganisms will disappear, only to return from hidden, relatively sheltered nooks and crannies when the protective process ceases, and when the individual's blood no longer elaborates enough immunizing substances.

Vaccine therapy, which attained such a vogue a dozen years ago, arose quite naturally from the researches of Koch, Metchnikoff, and their pupils. Its accurate and careful employment in our field by Coates,⁷ Coffin,⁸ Levy,⁹ Birkett,¹⁰ Dabney¹¹ and others was not undertaken until years of experiment had demonstrated its value and its safety. Nevertheless, in spite of warnings that this method was an adjuvant to and after surgical treatment, that it was no panacea, it was ruined and discredited for years because of overenthusiasm, commercial exploitation, excessive dosage and indiscriminate use in unselected cases.

Only in the past few years, since bacterial findings have been reconsidered with regard to Wright's opsonic index, and culturally with respect to hemolysis for human blood as well as that of animals, has it seemed that immunization by means of bacterial vaccines might again prove useful in the field of otolaryngology. We shall now discuss various clinical applications which have recently come into vogue.

As stated just now, distilled water sets the protective machinery of the blood in action by lysis of a few red cells. Against these autogenous released substances, protective substances are elaborated from the leucocytes with minimal irritation and distress, because no toxic element enters the blood stream, and the osmotic balance between isotonic blood cells and hypotonic distilled water is speedily restored. Purely local accumulation of antibacterial substances may be caused by subcutaneous or submucous implantation of sterile gauze or other sterile insoluble irritant.¹²

Direct transfusion of accurately typed blood from a healthy donor is not essentially stimulative of antibacterial action in

the recipient's blood; it is in the nature of a loan, assisting with protective agents of relatively low proportion in added quantity.

Autohemotherapy—withdrawal from a vein of five to ten cc. of the patient's blood, addition of sodium citrate solution to prevent clotting, and immediate submucous injection—has recently found European advocates for the treatment of ozena.¹³ Here a local effect from the release of autogenous protective substances as well as from the organization of the injected blood is expected. Much of the fluid escapes, owing to the atrophy of the submucosal tissue and the tightness of the scarred mucosa itself. Some clinicians report equal success from intramuscular injection.¹⁴

Of late, alien protein in various forms has been administered, both subcutaneously and intramuscularly. Boiled milk has been much used, and certain preparations of milk proteids are now available in ampules. On the assumption that the protein of killed bacteria is mainly responsible for such favorable revulsive action as occurs, some are using typhoid vaccine or killed cultures from the colon dysentery group. With all of these, rather violent reaction to the foreign substance occurs, with high febrile reaction, local swelling about the injection, occasionally nausea and extreme prostration. Thereafter very considerable improvement in the general condition of the patient should be manifest. This sort of treatment has been confined mainly to those indolent conditions which require a tremendous upheaval to bring about any change in their bacterial flora. Such heroic measures cannot be repeated oftener than once in a week or ten days; and they are totally contraindicated in the presence of organic heart or kidney disease, thyroid irritability or arteriosclerosis.

Considering the merits of so-called "stock" vaccines of polyvalent character—that is, containing an arbitrary number of millions of killed bacteria, of four to ten different sorts—we are struck by a certain resemblance to the alien protein inoculation. The mere fact that an average of a dozen cotton swab cultures from people with "common colds" in Philadelphia shows such-and-such organisms in such-and-such proportions does not in the least signify that this proportion and these organisms will be found in similar ratio in San Francisco or

St. Louis or New Orleans. Yet "cold vaccines" are used faithfully by many practitioners, who must be doing some good for their patients; otherwise these people would not ask for repeated immunization, two or three years running. One cannot help feeling that the alien protein response is again responsible for the success of these heterogeneous mixtures of varied potencies, with the added factor of some approximation in type to the bacteria which infest each affected individual. At any rate, similar antibodies are stirred up and brought into effective action. Drawbacks to such vaccines are their fluctuations in protective value, even from the same manufacturer—no two strains can ever be quite alike—and potency runs down from week to week. Also, there is danger of too rapid increase in dosage, with possible induction of sensitization to all the bacterial types employed, with their varying toxicities—a most disagreeable compound example of the so-called negative phase: Wright's apophylaxis.

Less criticism can be made of stock vaccines based on single organisms. Here again, however, arises the question of how nearly the stock organism approximates to that which infests the patient. If the patient's organism is determined by culture, which is the only accurate means of identification, why not carry the culture on and make an autogenous vaccine?

Autogenous products are at present being used along three distinct lines in otolaryngology, and each has definite values and objections.

The bacteriophage of d'Herelle, whatever its nature, is so striking in its destruction of dysentery cultures that it holds the zealous attention of bacteriologists throughout the world, and has even furnished material to a recent American novelist.* Nevertheless, it has recently been determined, after painstaking experiment in the clinic of Lemaitre of Paris,¹⁵ that practically only staphylococcic infection of the skin of the auditory meatus and nasal vestibule is amenable to the local action of the phage. The trauma of introducing it into the unpunctured tympanic membrane would effect a paracentesis, in itself remedial; yet no determination of the germ involved would be possible otherwise. So far, no streptophage has been discov-

*Sinclair Lewis: "Arrowsmith," 1925.

ered. In Hays' reports upon mass culture therapy, the possibility of bacteriophagic action is mentioned, but no experimental conclusions have as yet become available from his studies.

Certainly staphylococcic dermatoses, if treated by vaccine at all, can be managed much more easily by ordinary processes of autogenous or stock vaccination than by resort to the complex technic of isolation of the staphylophage. It is noteworthy that bacteriophage appears in an individual's cultures during convalescence, shortly before cure. Of course, if staphylophage, freshly prepared by lysis of young cultures, can be made available for the use of otolaryngologists in large clinical centers, very rapid healing of furunculosis or superficial pharyngitis can be expected by simple local application—gauze wicks, cotton rolls, even spraying or gargling the throat or dropping the bacteriophagic serum in the auditory meatus or nostrils. Slight abrasion of the skin near the furuncular area is suggested as a means of getting the lytic agent as close as possible to the site of pus accumulation.

Subcutaneous injection of two to four cc. of the bacteriophage is not recommended for more than three or four administrations, once daily. No general reaction occurs, but if more injections are given, the individual may develop antibodies against the bacteriophage; he would then be again sensitized to the staphylococcus and might again develop furuncles. A raised and painful area is usually observed for 24 to 36 hours after subcutaneous injection of this agent.

Bacteriophagic treatment should give quick results, and unless these are forthcoming at once other measures should be undertaken. Camus reports 37 cases of external otitis, of which 31 were well in less than four days. Four doubtful ones got well in ten days, and two were not helped. Mixed infections, including staphylococci, were not improved, nor were chronic infections influenced at all.

Since this agent is destroyed by heat above 75° C., and can only be obtained by very careful filtration, it is not likely soon to become generally available. Nevertheless, its lytic properties are preserved at room temperature for several years, so that it would be a most convenient agent where obtainable.

Following the work of Besredka of Paris in typhoid prevention by the administration of killed typhoid bacilli by mouth, Hays began the use of mass cultures upon broth for the relief of purulent accessory sinus disease. This work, first reported in May, 1925, at the A. M. A., has been continued by Hays with numerous favorable reports ever since. He uses a cotton swab, inoculating a flask of sugar bouillon, which is incubated for 48 hours and killed by heat. Apparently little account is taken of the different rates at which various organisms grow in vitro, or of the possibility of certain species of high specific toxicity being overgrown entirely by saprophytic organisms of low virulence.

This killed bacterial suspension may develop rather foul odors, especially in cases of atrophic change. Filtration and washing of the bacteria and their resuspension in normal saline solution eliminates the odor, but, according to Hays, probably also eliminates some actively bactericidal properties of the broth.

Such mass cultures are administered by packing the nose with gauze strips saturated with the broth, leaving them in place for twenty minutes; or by direct injection into the antrum; or by spraying with an atomizer. Brilliant results are claimed in relief of nasal discharge, in avoidance of operative procedures and in clearing up delayed postoperative healing.

It should be noted that by this method no exact measure exists for the concentration of toxins in the killed culture, or for the relative amounts of various toxins, whether in the bodies of the dead bacteria and subject to release in the warm recesses of the highly vascular nasal mucosa, or free, in the liquid, to pass down the pharynx and into the esophagus. No exact amount of the broth is recommended for use at each of the eight treatments which are spread out over four weeks' time. It would seem that in less skillful hands than those of Hays danger might sometimes arise from the absorption of such unknown quantities of unknown toxic agents. He imposes no limitations for age or infirmity, stating specifically that this method is less difficult than hypodermic administration in children.

Hays does not attempt to analyze the immunologic processes by which mass cultures obtain their effects; it is certain that

the large area of turbinal mucosa affords an ideal absorptive surface, even though the mucosal linings of the affected sinuses are not directly reached. Ciliary epithelial outflow, and lymphatic drainage toward the neck, quite effectually prevent vaccine thus administered from traveling uphill into the sinus cavities. Possibly the vacuum inverted pumping of Proetz might be applicable, securing direct contact with the infected surfaces.¹⁷

Numerous cases in which we accurately followed the Hays-Winslow¹⁷ technic were insufficient to assure us that the proceeding lacks danger. Several seemed to benefit decidedly; but with control cases, packing for stimulation of the turbinals after shrinkage, using plain normal saline solution on the gauze, almost equal relief was reported. One case, an elderly man with ethmoidal discharge persisting in spite of rather extensive operative procedures some time before, was very sanguine of good results as he went home from the first application of his culture. Within two hours his blood pressure had risen thirty points, however, and he experienced a rather stormy period of cardiac incompensation, in bed for three weeks. Appreciating the zeal of its proponent, we cannot help issuing a warning regarding the dangers of "mass culture" vaccine from rhinologic cases where sensitization from rapid absorption may activate an existing weakness in the heart, kidneys or endocrine system.

Hemeleers¹⁶ apparently relies on the Besredka principle when he injects autogenous vaccine into the pus pockets of infected othematomata; he claims swift healing and minimal deformity. Sanarelli¹⁸ uses the nasal portal for inoculation against dysentery, cholera and typhoid, making the killed culture into a snuff with gum arabic, and securing protective absorption by the turbinals.

It will be recalled that Wright imposes accurate limitations upon the dosage of vaccines, not only because of possible sensitization through excessive reaction, but also because some of the apophylactic effect may come from other proteins in the mixture than those of specific bacteria. Upon this basis peptone solutions, milk and bacterial combinations quite foreign to the major infective process have often been tried. We secured no benefit from typhoid vaccine in chronic sphenoth-

moid disease. But in severe iridocyclitis from sinus infection we have seen decided improvement in the nasal situation, as well as the eye, following the febrile reaction from milk injections.

It is interesting to note that Wright's recent therapy for cases of so-called infectious asthma arises from a specific infective agent which has transferred its base of operations. He reverses the reasoning of Solis-Cohen as to the nasopharyngeal etiology of much visceral disease, and has worked out an elaborate technic for the recovery of hemolytic species, mostly streptococci, from the large intestine. These germs, he contends, started in the nose and throat, sensitized the individual, and having been swallowed, found congenial lodging in the byways of the lower bowel. In the presence of intestinal stasis their toxins accumulate, and asthma and nasal obstruction of severe degree occur. His cultural methods and differential platings are tedious, but when the specific organism is discovered and made up into a vaccine, results from its administration are extraordinarily brilliant. Two cases have come to our knowledge—both incapacitated by years of increasingly severe asthmatic seizures; both temporarily relieved by extensive nasal surgery, only to relapse in spite of every local measure, and finally enslaved to adrenalin hypodermatically in palliation. These individuals are both trained medical observers, and have been for two years now entirely free from asthmatic attacks.¹⁹ Whether other species may later develop other lines of allergic attack upon them is, of course, an open question; but of their present immunity to this strain from the bowel, toxic to the upper respiratory vasomotor system, there can be no doubt.

We are not familiar with any present attempt to attack the problem of ozena by vaccines, following the interrupted studies of the late Henry Horn. Bacterial invasion in such cases seems secondary to the atrophic widening, and recent therapy is directed toward this mechanical factor.

I need do no more than remind you of the constant demand made upon us by the internists to locate "foci of infection," to bring up numerous personal recollections of cases of visceral disease, arthritis and iridocyclitis which have been clinically cured by surgical removal or drainage of the source of

trouble: tonsils, teeth, accessory sinuses, chronic middle ear and mastoid suppuration. Exact specificity of organisms has been repeatedly demonstrated in such cases. Let us, however, be honest and admit that many of the hopes expressed by our colleagues in internal medicine are too rosy; that after never so careful an ethmoid exenteration there will sometimes be colds and recurrence of the old, distant symptoms.²⁰ Undoubtedly many cases get well and stay well; but the internist's accurate reproduction of endocarditis in a rabbit inoculated with antrum pus, while it may prove the specificity of the hemolytic streptococcus isolated from his case of mitral disease, is no assurance that drainage of that antrum will keep it permanently dry. Nor does it mean that the cardiac condition will be secure from recurrence in cases of such chronicity.

Realizing the limitations of traumatized nasal and aural tissues in elaborating a defensive mechanism after years of a losing fight against chronic infection, our department in the University of Oregon Medical School took counsel some years ago with Dr. Robert L. Benson of the department of pathology. He suggested the use of media containing human blood for our effort to secure valid growths of the hemolytic types of organisms found. We have, since 1925, been culturing all chronic nose and ear cases which have failed to respond to surgical measures, which have already been operated upon to excess without relief, or which, for systemic reasons, are unfit for surgery. These were all private, not clinic cases, requiring our best attention; for we are inclined to agree with Molière's old Dr. Diafoirus, that "Common folk are easy; nobody holds you responsible for your actions, and providing one follows the current rules of our art, one needn't worry about what may happen; but the annoying thing about great folks is that when they fall sick they absolutely want their doctors to cure them."*

The first series of our cases was reported to the American Laryngological Association in 1925.²¹ Out of fifty cases studied, only thirty showed hemolytic species, including streptococci (long and short) and staphylococci, both white and yellow. The hemolytic staphylococcus aureus was found in

*Molière: "Le Malade Imaginaire," act II, sc. vi.

nearly half of our cases, twice as often as the streptococci; hemolytic staphylococcus albus in one-third of the cases. Ten cases showed nonhemolytic streptococci and were used as controls; three cases with asthmatic symptoms, without hemolytic organisms, were inoculated with typhoid vaccine as controls; and seven cases without either hemolytic species or streptococci were not further considered for vaccine therapy.

Our method of securing material is simple: a long platinum wire loop is swept back across the posterior end of the middle turbinate into the sphenothmoid recess of each side, and inoculated upon human blood agar slants and into human blood broth. Much care is taken to avoid touching the speculum and outer parts of the nose. Repeat cultures are sometimes necessary to secure the organism; and it is important that secondary cultures every month or six weeks shall keep abreast of any changes or disappearances in the bacterial flora.

We were very much gratified to find clinical cure of nasal discharges, of sphenopalatine neuralgias, of recurrent colds, of intractable cough, low fever, asthma and numerous other symptoms of long standing, in some 73 per cent of these thirty chronic, last resort cases. Similar clinical cure came to only 30 per cent of the ten cases showing nonhemolytic streptococci; while the three asthmatics treated with typhoid vaccine experienced no relief, although all had considerable reactions.

Recent checks upon the twenty-three cured hemolytic cases show that after two to four years all but five persons are clinically still well. Of these five, three are women, suffering from endocrine dyscrasias beside their old sphenothmoid conditions; so that, although free from their hemolytic organisms, they still have occasional migraines of the sphenopalatine type. Numerous repeat cultures have been taken, and in two allergics of the series, hemolytic organisms having been found again, prophylactic vaccines were given. There have been only four recurrences of symptoms necessitating new courses of vaccines; these also have been in the allergics, with asthmatoïd symptoms. In most of the cases in which we noted improvement instead of cure, the amelioration has continued in spite of the hazards of two winter seasons since the date of our report. One case with streptococcus viridans associated with hemolytic staphylococcus albus has had two recurrences in an

extensively opened antrum, but retains the physical improvement manifested after his first course of vaccine.

Our only experience with hemolytic vaccines in the ear was a brilliant cure of chronic nephritis and severe secondary anemia in a child whose mastoid had been previously operated upon. Chronic osteomyelitic changes in some deep zygomatic cells yielded short chain hemolytic streptococci; and under the vaccine thus secured his convalescence was very rapid. His period of stunting and arrested development, with chronic kidney involvement, had lasted three years. He is now a rapidly growing, robust boy. Of course, much of the improvement must be laid to the coincidental surgical care.

A second series selected under similarly rigid restrictions, including last resort, overoperated or inoperable cases, has come under observation from May, 1925, until the present, and includes twenty-six individuals showing a preponderance of human hemolytic cocci, out of thirty-nine examined. A slight increase in the proportion of posterior ethmoid involvement and of the number of individuals showing fairly high secondary anemia was noted in this series. *Staphylococcus aureus* in 42 per cent, *staphylococcus albus* in 30 per cent, and streptococci in 27 per cent—all hemolytic—tally very closely with results in the first series. Four cases had to be cultured twice over to secure the toxic organisms. Final figures cannot be given accurately, since eight of the series are still under treatment; but it is interesting to note that 46 per cent remain clinically well this winter; 38 per cent are very greatly improved and are in the main free from the original toxic agent as proved by culture; and but one has experienced no relief. Three cases, in spite of very great caution in administration, experienced severe general reactions from the vaccine, which was stopped. Probably this sensitiveness to the vaccine was due to the fact that these three cases were very weak persons, just recovering from severe general illness. We were probably unwise to begin at all, even with the very small initial dose, 0.025 cc. of a two billion dilution, which we now use for convalescents, delicate women and young children. Experience with occasional reactions has caused us to set the top dosage for a child at 0.3 cc., and we rarely exceed 0.5 cc., even with the most robust adults. Administration twice a week,

going up in dosage 0.05 cc. to 0.1 cc. each time until the maximum is reached, is our rule. Then the optimum dose, just short of reaction, is given once a week, five to fifteen maximum doses in all.

Based upon these two limited series of clinical observations, we are led into agreement with Wright,²² who says that "we should consider carefully, in cases of grave infection, whether the patient has any capacity for making immunizing response." The very sick patient will get more harm than good from intravenous vaccines, and may more properly be transfused with an immune serum. Any helpful gesture is, in our opinion, justifiable toward these unfortunate derelicts, who worry along from rhinologist and oculist to psychiatrist and dietician, with occasional excursions to rest cures, nervous sanatoria, Havana, Asheville, Honolulu, or the almshouse.

Perhaps from a fuller comprehension of the biochemistry of the nasal mucosa²³ we may find explanations for the ability of certain microscopic plants to grow through into our bodies and scatter seeds of destruction in our blood. The era of pathology interpreted from dead, stained specimens is past—before our eyes, and upon a carpet of living cells, living corpuscles and living bacteria must join battle and disclose their plans of offense and protection. What electric charges these things carry toward each other; wherein their activities are helped or hindered by colloids within the cell, or by osmosis through the cell wall; whether bacterial proteins and allergic excitants are katalyzers to these chemic reactions—such are some of the matters upon which we await enlightenment from our brethren of pure science, divorced from clinical exigency. As practicing physicians we are prone to jump at conclusions, to take the wish for the deed, to interpret results in terms far too roseate. In our zeal to help the sick, we are likely to be tempted by the promises of empiricism or fettered by old dogmas. We should recall Darwin's modesty: "Though I of course believe in the truth of my own doctrine, I suspect that no belief is vivid until shared by others."*

The research physiologist, bacteriologist and biochemist have no patients demanding cures. These men are at work out be-

*Life and Letters of Charles Darwin, Vol. II, p. 19.

yond the snow line, in the chill and quiet of the mountain summits of truth. The icy clearness of alpine sunshine is upon their decisions and their counsels. Let us, therefore, so far as may be, support such research and assist in the clinical application of its findings. Let us not again abandon the field of vaccine therapy to commercial exploitation, as occurred ten years ago. Let us rather encourage our full time, hard worked, underpaid but devoted scientists in these fields, remembering the medieval advice of Voschius: "Good scholars should be highly rewarded, and had in some extraordinary respect above other men, to have greater privileges than the rest, that adventure themselves and abbreviate their lives for the publick good."* The research men must teach us something of their catholicity of view, clarity of purpose and exactness of interpretation if we are to make successful application of the principles of vaccine therapy which they have established.

MEDICAL ARTS BUILDING.

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XXXVII.

VACCINOTHERAPY IN OTOLARYNGOLOGY.*

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The members of the Philadelphia Laryngology Society are to be congratulated upon having heard so interesting and valuable a contribution on "Vaccine Therapy in Otolaryngology" as that given by the guest of the society, Dr. Ralph A. Fenton, who has traveled almost across the continent in order to be here this evening.

We are also greatly honored by the presence of Dr. John A. Kolmer, who, in my judgment, is the master mind on all questions concerning immunity, susceptibility and vaccine therapy.

I shall confine my discussion of vaccinothrapy to chronic infective tonsillitis, and leave all other questions to Dr. Kolmer and others.

It is all important to remember that the basic treatment of chronic infective tonsillitis is its complete surgical removal. Dental or sinus infection frequently coexists with chronic infective tonsillitis. If a vaccine is employed and an infected tonsil or remnant or other foci of infection remain, the beneficial influence of vaccinothrapy must necessarily be transitory, as the toxins or bacteria or both are continuously or intermittently entering the circulation.

In determining when vaccinothrapy is indicated, and the therapeutic results, the patient as well as the disease should be given full consideration.

Vaccinothrapy is of decided value, and in certain cases may save life. Failure of vaccinothrapy may be due: (1) To the bacteria or the strain selected for making the vaccine differing from that from which the patient is suffering; (2)

*A discussion of Dr. Ralph A. Fenton's address on "Vaccine Therapy in Otolaryngology," read before the Philadelphia Laryngological Society, January 11, 1927.

because the vaccine is improperly prepared or unduly exposed to heat; (3) the dose or interval not having been accurately adjusted, or (4) the presence of an undetected focus of infection.

Hypersusceptibility to a small dose of autogenous vaccine may be due to an undetected focus of infection.

Streptococci in a secondary focus of infection, such as the joints, gall bladder or endocardium, may be so modified by the new environment that a vaccine made from the primary focus may be useless. The environment of the bacteria in the crypts of tonsils and the periapical regions of teeth differs markedly from that in the sinus or mastoid; while in the former the streptococcus hemolyticus or viridans predominates, in the latter it is the staphylococcus aureus or albus.

A pure culture of the streptococcus hemolyticus was discovered in a case of ethmoiditis, which Dr. Fenton will recall having seen with me in consultation with Drs. Skillern and Somers.

Chronic infected tonsils may secondarily infect a pathologic liver, due to syphilis or alcoholism, or tubercular lungs, and vaccine therapy may be of value after the removal of the infected tonsils.

Accurate diagnosis is important, as is illustrated by the following case of chronic furunculosis, which was given an autogenous staphylococcic vaccine and recovered. In a few weeks the boils recurred and again disappeared after vaccine treatment, and then furunculosis occurred for the third time. Syphilis was then diagnosed, and permanent recovery followed the use of arsphenamin.

Chronic infected tonsils may exist unrecognized for one to twenty or more years. During a part or most of this time toxins and bacteria enter the circulation. If an infected tonsil is surrounded by fibroid tissue so that no absorption is possible or the virulence or the amount of toxins or bacteria be small or the resistance great, the individual may present no sign or symptom of disease, but sooner or later, owing to increased virulency or the absorption of larger quantities of toxins or bacteria or loss of immunity, disease appears. The entrance into the blood of small quantities of bacteria and toxins in a healthy adult over a period of years acts as a vaccine, stim-

ulates the formation of antibodies and increases immunity. The normal healthy young adult possesses an immunizing mechanism that fails only when the infection lasts for years or when the amount of virulence of the toxin or bacteria is excessive or immunity is lost.

Immunity, as a rule, steadily declines with advancing years, from the wear and tear or stress and strain of life, or may be suddenly lost when the individual is subjected to an intercurrent disease like typhoid fever or influenza. It is probable that immunity may be suddenly and temporarily diminished by loss of sleep, excessive work, insufficient food or long exposure to cold, and may be as suddenly regained.

Local immunity may be diminished or lost by extension of the local process.

A healthy young adult, whose tonsil has been infected for a few years, usually makes a rapid recovery after tonsillectomy without a vaccine, although a vaccine would accelerate recovery.

Vaccinotherapy is especially valuable after tonsillectomy in those advanced in years, debilitated, anemic, emaciated or suffering from complications, such as diabetes, syphilis, tuberculosis, hepatic cirrhosis or advanced cardiovascular or renal disease, and vaccinotherapy may be of value by increasing the resistance of a patient who is a bad surgical risk and requires a tonsillectomy.

Anemia, leucopenia or lymphocytosis indicates that toxins or bacteria or both are being absorbed into the circulation and that immunity has been diminished or lost. This blood picture disappears permanently after the removal of all foci of infection and only temporarily if any focus is overlooked.

Dr. Ross H. Skillern may remember a lady past three score and ten, whose life was saved by the removal of small, submerged, infected tonsils. After the removal of infected teeth marked improvement followed, with the disappearance of anemia, leucopenia and lymphocytosis, which recurred several months later and permanently disappeared when the undiagnosed infected tonsils were removed.

A stock vaccine is usually easily procurable and is often of value. I agree with Dr. Fenton that autogenous vaccine should be preferred. The ease with which stock vaccine may be secured

and given sometimes leads to neglect in identifying the bacterium causing the infection. Such a procedure is purely empirical or experimental, and is to be condemned. The profession has long ago learned that it is exceedingly difficult to be sure that the improvement following the giving of a drug is due to the drug, and this is equally true of vaccine therapy. In olden times a shotgun prescription was employed in the hopes that one of the remedies would be beneficial, and certain polyvalent vaccines strongly suggest a shotgun prescription, in a new form.

It is interesting to observe the hypersensitiveness of certain patients to minute quantities of vaccine, but it should not be forgotten that the benefits secured do not depend upon the amount but upon the effect of the vaccine. Occasionally a vaccine will cause a temporary exacerbation of one of the dominant symptoms, such as the pain of an arthritis or neuritis, the return of arrhythmia or the aggravation of the symptoms of meningoencephalitis. This is a favorable sign, indicating that the vaccine possesses selectivity but that the dose is excessive.

I have been in the habit of employing a vaccine, of which 1 cc. represents one billion of bacteria and the primary dose is 0.1 cc. given subcutaneously in the upper arm at intervals of four or five days, and each successive dose is increased 0.1 cc. until ten or more doses have been taken. If a skin, focal or general reaction occurs, the succeeding dose is reduced accordingly and the next following dose is again increased. Vaccine sufficient to cause a moderate skin reaction may not cause a general reaction.

Many physicians believe that it is beneficial to induce a marked general reaction. My experience leads me to strongly oppose this view, more especially those in cases where vital organs are involved. So far as possible, the amount of vaccine given should represent the maximum subreaction dose. As the reaction usually occurs six or eight hours after the vaccine has been given, it is best to give the vaccine in the morning after breakfast, otherwise, if given in the evening, sleep may be disturbed.

The vaccine should be kept in the refrigerator until ready for use and should be returned to the refrigerator immediately

afterwards, as heat diminishes its efficiency. The vaccine should be given aseptically, preferably by a platinum needle attached to a 1 cc. syringe which has a scale divided into one hundred parts. The bacteria in a vaccine are killed by heat, preserved by 0.3 per cent solution of phenol, and the bottle should contain a number of small glass balls, so as to facilitate making a thorough mixture at the time it is removed for injection, and the top of the bottle should be covered with a sterile rubber cap.

It is important to determine the identity and at times the pathogenicity of the bacteria in the crypts of tonsils causing systemic disease. If these bacteria grow freely in the patient's blood it indicates susceptibility, and vice versa.

The superficial parts of the tonsillar fossæ and throat normally contain streptococci, staphylococci and other microorganisms. These bacteria may play no part in the production of symptoms.

In securing material from an infected tonsil for a culture or a vaccine, a platinum loop should be gently inserted into the mouth of a crypt and slowly passed to the bottom, as the materials in this region contain pathogenic bacteria. This material, promptly placed upon suitable culture medium, soon shows colonies of the predominating bacterium, which is usually the streptococcus hemolyticus or the streptococcus viridans, and occasionally these bacteria coexist. Sometimes the staphylococcus aureus, hemolyticus, the pneumococcus or some other organism is the one causing disease. Occasionally streptococci in one tonsil may differ from those obtained from a crypt in the other tonsil, or a streptococcus hemolyticus may, after several months, be converted into a viridans.

Tonsillar crypts are sometimes sealed by adhesive inflammation, so as to prevent material being secured from the bottom of the crypt, so that a negative culture does not prove that a tonsil is not infected. Infra- and retrotonsillar abscesses cannot be diagnosed by culture.

It is important that the vaccine should be made with as few transplants as possible, as the streptococcus tends to lose its specificity and pathogenicity by many transplants or by long exposure to the air or heat.

It is well known that many normal mouths contain streptococci incapable of producing serious disease, and it is equally well known that the streptococcus of scarlet fever differs in its action upon the body from the streptococcus of erysipelas or measles or the streptococcus recovered from an infected tonsil. It is also generally admitted that the streptococcus hemolyticus or viridans retains its pathogenicity and specificity, if grown in the absence of oxygen. It is, therefore, easy to understand how important it is not only to properly obtain materials for culture but also to rapidly secure a sufficient growth with as few transplants as possible in making a vaccine.

In view of the extraordinary difference in selectivity and pathogenicity of various strains of streptococci, the making of a vaccine that exactly meets the needs of the patient necessitates unusual skill.

In estimating the value of vaccinothrapy, due credit should be given to surgery and Nature.

A vaccine may be compared to a key and the disease to a lock. We all know how seldom a Yale key, accidentally secured, fits the particular Yale lock that we desired to open.

XXXVIII.

A RHINOLOGIC STUDY OF BRONCHIAL ASTHMA.

BY VERNON L. BISHOP, M. D.,

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Bronchial asthma is clearly recognized today as a symptom and never as a disease as such. Osler,¹ in his fifth edition, defined asthma as "a neurotic affection characterized by hyperemia and turgescence of the mucosa of the smaller bronchial tubes and a peculiar exudate of mucin." It is, however, only within the past fifteen years that any notable accomplishment has been made in the investigation of cause and prevention of this distressing condition. During the past decade very interesting studies have been reported by students of anaphylaxis and allergic sensitiveness, roentgenologists and rhinolaryngologists. Briefly summarized, the history of the development of our present conception of asthma is about as follows:

Blackley,² in 1873, demonstrated the relation of pollens to seasonal hay fever.

Cole,³ in 1909, using sterilized infusions of buckwheat, obtained a positive skin reaction.

Meltzer,⁴ in 1910, declared that asthma is a clinical manifestation of anaphylaxis.

Schloss,⁵ in 1912, made diagnostic use of skin reactivity in a case of allergic reaction to egg, almond and oat.

Goodale,⁶ in 1916, Walker,⁷ in 1917, Rackemann,⁸ in 1918, and contemporaneously, Cooke,⁹ Coca,¹⁰ and Van derVeer¹¹ and others wrote extensively of their work in cutaneous reactivity and the relation of individual hypersensitiveness to asthma.

The conclusions of the above students of allergy and hypersensitiveness differ on the essentials, but are corroborative as to the specific proteins causing skin reactivity, and have demonstrated the fact that about 40 per cent of asthmatic cases show a skin reaction to one or more specific proteins. However, in a considerable percentage of cases of asthma, no skin reactivity has been demonstrable.

Roentgenologists, since 1920, have reported instances of disappearance of asthmatic attacks following treatment of chest conditions with the X-ray. Cases have been reported by Bachem, Epstein, Gottschalk, Groedel and Lossen, Gerber and Stern. No data indicating the percentage of recoveries has come to the writer's notice, nor is the rationale of the treatment entirely clear. Harkavy,¹² in 1922, found, in a series of 160 cases studied that year, nine cases regarded as definitely bacterial in origin and not responding to cutaneous tests for the bacteria employed, that had evidently resulted from unresolved pneumonias and cleared up with improvement in the pneumonic condition. Four of these nine cases improved following X-ray treatment of the lung. Harkavy said,¹² "The object of treatment is to stimulate the defensive factors of the body (plasma activation), in order to get rid of the responsible disease focus." Stern,¹³ in 1925, said, "Improvement following X-ray is probably due to the more rapid stimulation of antibodies."

Huber and Koessler,¹⁴ in 1921, made histologic studies of the finer structures of the bronchi and found, in certain cases, hypertrophy of the mucous gland system, and in others hypertrophy of the smooth muscle system. They described two cases on an infectious basis.

Rhinolaryngologists have made interesting observations. Dr. Sidney Yankauer noted an edema of the bronchial mucosa, with isolated areas of hyperemia. W. F. Moore,¹⁵ reporting his observations of tracheobronchial asthma before this society in 1925, concluded:

1. "For this group we believe the etiology to be traceable to an active attenuated bacterial infection of the tracheobronchial tree."
2. "Those associated with a demonstrable tracheobronchitis have responded best to bronchoscopic treatment."
3. "Impairment and actual destruction of the ciliary action has been conclusively demonstrated. We believe its restoration imperative for lasting improvement."
4. "Reestablishment of ciliary action occurs after the secretion which has inhibited its function has been removed by swabbing or aspiration."

Haseltine,¹⁶ reporting 110 cases that had remained asthma free for a minimum of two years, summarized as follows:

1. "Asthma is a toxic state due to disturbed metabolism."
2. "The toxic state may exist and produce many different clinical manifestations, but will not produce bronchospasm unless some ethmoid irritation is present."

Review of the literature revealed a variety of opinions concerning the etiology of asthma, some of which would seem to be not entirely sustainable in the light of our present knowledge, but during the past decade definite advancement has been made in the study of the etiology and treatment of certain types of asthma. However, there has at no time been reported by a rhinolaryngologist, or adopted by a rhinologic society, any classification of asthma that tends to differentiate the various types and enable the rhinologist to determine in any given case of asthma whether or not it is susceptible of improvement by rhinologic treatment. An object of this thesis has been to present such a classification, adopted by the writer in 1920, while working in the nose and throat section of the Massachusetts General Hospital, in contact with Dr. Rackemann's Anaphylaxis Clinic, and applied consistently in the study and treatment of these cases during the past five years.

CLASSIFICATION OF ASTHMA.

Extrinsic asthma:

- A. Pollen hay fever and asthma.
- B. Dust asthma.
- C. Food idiosyncrasy.

Intrinsic asthma:

- D. Bacterial asthma.
- E. Reflex asthma.

In a study of 648 cases, Rackemann¹⁷ classified asthmatics into two main groups:

"1. Those sensitive to foreign proteins, in which the cause is outside the body (extrinsic), and

"2. Those not sensitive, in which the cause is inside the body."

In his conclusion of a study, in 1918, of 150 cases, Rackemann⁸ reported: "Extrinsic asthma included 28 per cent, and

intrinsic asthma 53 per cent of the entire group, the other 19 per cent being unclassified."

Extrinsic asthmas show a definite relationship to foreign proteins, which may enter and act upon the body in several ways, particularly through the respiratory tract, as in groups A and B, through the gastrointestinal tract, as in group C.

Intrinsic asthmas show no known relationship to foreign proteins. The cause is to be sought within the patient's body. Under "Bacterial Asthmas" are grouped those cases of asthma which would seem to have resulted from a toxemia incident to bacterial invasion, as found in focal infection of tonsils, nasal sinuses, teeth, lungs and other more remote parts of the body. Under "Reflex Asthmas" are grouped those cases of nonsensitive asthmas in which no evidence of focal infection can be found but in which the bronchial spasm is believed to be the result of reflex nerve irritation.

The above etiologic classification of asthmas, the writer believes, can be made of great help to rhinologists. A review of cases examined and treated by the writer during the past five years developed the fact that those cases relieved or improved belonged to the group of intrinsic asthmas. Some cases of extrinsic asthma showed improvement following correction of nasal defects, but so long as they remained sensitive to pollens, developed some asthma in pollen season. The improvement noted in these cases would seem to have been directly proportional to the improvement in the ventilation of the nares. The most valuable conclusion drawn by the writer from his study is that in the treatment of asthma the rhinologist will find his activity most fruitful of results in proportion to the extent he confines his treatment to asthmas of the intrinsic group.

INTRINSIC ASTHMA.

About 50 per cent of the asthmatic cases studied were classifiable as intrinsic asthmas. Rackemann's grouping of 648 cases showed approximately 60 per cent intrinsic asthmas. For purposes of rhinologic study and treatment, intrinsic asthmas are divisible into two distinct groups: bacterial asthma and reflex asthma.

BACTERIAL ASTHMA.

Of bacterial asthmas, Rackemann stated:¹⁷ "Group D represents perhaps the most common group, which can be subdivided as follows:

"1. Where asthma dates from a definite acute respiratory infection (13 adults and 4 children).

"2. Cases in which there is each year a rather sharp and severe, but relatively short, attack of asthma occurring with the first cold spell of autumn and often recurring with the violent changes in temperature in March.

"3. Cases of 'winter' asthma, where the symptoms are closely associated with the cold weather of New England; are persistent and present practically constantly until the spring. Any fresh cold makes them markedly worse. All of these cases were in adults. Their separate classification is perhaps artificial, since many cases closely resemble the cases of perennial asthma to be discussed later. The group should be recognized, however, because a change to a warmer climate is an efficient and valuable treatment.

"4. Bacterial asthmas in children, 38 cases, which come on most often after a cold and last for variable periods—the important point being that between the attacks these children are quite well. In case they are not quite normal between the attacks, and still retain a certain amount of wheezing and dyspnea on exertion, it is usually found that they have mild emphysema, large peribronchial lymph nodes or some other organic cause for the symptoms. In each of these subgroups the tests are ordinarily negative, but seven children have been added, in spite of a positive test, since nothing in their story seemed to agree with the test."

The nose and throat have an etiologic relation to bacterial asthma, as a causative factor, in proportion as it is found to contain the foci of infection responsible for the asthmatic condition.

REFLEX ASTHMA.

Bronchial spasm may result reflexly. Experimentally, it can be produced by overstimulation of the autonomic nervous system, as in vagotonia. The writer is of the opinion that the site of irritation or stimulation may be in the nose, notably in

hyperplastic ethmoiditis. To develop this point, it would seem a necessary digression to review somewhat the anatomy and physiology of the nasal mucosa and the nerve mechanism involved in these reflexes.

Fraser,¹⁸ in a study of "nasal" neuroses, has reviewed this subject quite clearly. With this acknowledgment, liberty is taken to quote quite freely from his thesis, which abstracts mainly the work of American writers.

"The nasal mucous membrane consists of several layers. If we take the inferior turbinals, we find, next to the bone, a layer of periosteum, containing numerous elastic fibers. Just outside this lie the larger blood vessels and nerves. In the delicate submucous connective tissue are a large number of thin walled blood sinuses, which compose the erectile tissue of the turbinal. Along with these are numerous mucous glands, the ducts of which open at various points on the surface. The superficial epithelium consists of several layers of cells, the most superficial of which is of the ciliated columnar variety, while the deeper cells are spindle shaped and cubical. The latter lie on a delicate basement membrane. The elastic fibers from the periosteum radiate out and around the blood sinuses and mucous glands; they end in a fine network beneath the basement membrane. These fibers, no doubt, aid in the shrinkage of the nasal mucosa when the vascular engorgement of the blood sinuses is over. The nasal mucosa appears to be constantly passing through three stages—(1) engorgement, (2) secretion, followed by (3) a resting stage.

"In the milder varieties of nasal neurosis only the upper part of the respiratory tract is involved. The patients complain of intermittent blocking of the nasal passages, especially at night. This condition is often seen in overworked people, especially in brain workers. In the second degree of nasal neurosis we have increased secretion, and frequently attacks of sneezing along with the nasal obstruction. The sneezing attacks are often of a violent and prolonged character. In the last and most severe form the lower portion of the respiratory tract is also involved, and we have well developed attacks of asthma and increased bronchial secretion.

"Many of the nasal neuroses are erroneously attributed by patients to the effects of chronic or recurrent 'colds' in the

head—that is to say, to attacks of rhinitis or coryza. It must be obvious to us that many of these cases are not really due to infectious rhinitis—i. e., they are not caused by bacterial infection of the nasal or respiratory mucous membrane. For instance, a patient complains that, on getting out of bed in the morning, he immediately suffers from a sudden attack of sneezing. Here the reflex is much too quick to be due to any bacterial or toxic action.

“The nerve mechanism involved does not belong to the voluntary, or ‘animal’ portion of the nervous system but to the involuntary, or ‘vegetative’ system.

THE NERVE MECHANISM INVOLVED.

“Fetterolf,¹⁹ following the work of Eppinger and Hess, states that the nervous system may be divided into two sections, (1) the animal, and (2) the vegetative. (1) The animal group consists of sensory and motor fibers and supplies the organs of sensation and the voluntary muscles. (2) The vegetative system, on the other hand, supplies all glands that have ducts and all involuntary muscle tissue. The vegetative system consists of two distinct parts: (A) the autonomic, (B) the sympathetic systems. These two cannot be separated by dissection, but through various tests their individuality has been established beyond question.

“The place of origin of the vegetative fibers is the brain and spinal cord. The sympathetic portion arises from the cord alone, beginning at the second thoracic nerve and continuing down to and including the second lumbar.

“The fibers which comprise the autonomic portion arise in part from the brain stem, and in part from the sacral region of the cord. The former, with which we are concerned in this abstract, are contained in the third, seventh, ninth, tenth and eleventh cranial nerves. The autonomic fibers of the seventh nerve (*pars intermedia* of Wrisberg), with those from the ninth, tenth and eleventh, go to sundry ganglia whence secondary or postganglionic fibers emerge. These innervate the blood vessels of the mucous membrane of the mouth, throat, nose and paranasal sinuses, the salivary glands, the heart muscle, the glands and musculature of the digestive tube, from the esophagus to the colon, as well as the blood vessels and tubules

of the kidney. In action, the two groups—the autonomic and the sympathetic—are antagonistic, and it is generally conceded that all glands which possess ducts and all involuntary muscles receive a supply from both. Upon the maintenance of a proper balance between the two depends the normal functioning of the structures to which they go. If the autonomic supply is irritable, the organ will overfunctionate in one direction. We then have the condition of 'vagotonia'—i. e., hypertonus of the above mentioned group of nerves, called the 'extended vagus.' If the sympathetic is in a condition of hypertonus—'sympatheticotonia'—the excessive action will be in the other direction. The results are manifested by hyper- or hyposecretion on the one hand, or by spasm or relaxation on the other—i. e., in vagotonia we have hypersecretion and spasm, while in sympatheticotonia we have hyposecretion and relaxation.

"The symptoms of vagotonia in general are those of stimulation of the autonomic system—e. g., congestion and hypersecretion in the nose and pharynx (sphenopalatine and submaxillary ganglia), gastric crisis, hyperperistalsis, excessive gastric and intestinal secretion, bradycardia, laryngeal crisis, bronchial asthma and hypersecretion (vagus).

"The medical treatment of vagotonia may take one of two forms—(1) sedative treatment of the autonomic system, or (2) stimulation of the sympathetic system. For example, spasmodic bronchial asthma may be treated by quieting the autonomic system with atropin or by stimulating the sympathetic by the local or hypodermic use of adrenalin.

"For purpose of clearness in understanding the nerve mechanism of nasal reflexes, we will consider the component parts of the reflex arc backward from the organ affected to the source of stimulation, as follows:

- "1. The efferent nerve mechanism;
- "2. The central mechanism;
- "3. The afferent nerve mechanism.

THE EFFERENT NERVE MECHANISM.

This consists of preganglionic and postganglionic fibers. The latter directly excite to activity the epithelium of the glands and relax the muscle fibers of the blood vessel. They originate

in the sphenopalatine (Meckel's) ganglion, situated in the sphenomaxillary fossa. (The otic, sphenopalatine and submaxillary ganglia, though anatomically associated with the trigeminal nerve, are not integral parts of it; they belong to the autonomic system and are associated with the vasomotor and secretory system of nerves. They possess neither sensory nor motor functions.) From their origin in Meckel's ganglion the nerve fibers pass to the glands and blood vessels of the nasal chambers, palate and upper portion of the pharynx. The ganglion cells, though irritable, are devoid of autonomic action and must be excited by nerve impulses discharged by the nerve cells, in the central nervous system, and transmitted by the preganglionic fibers. These fibers originate in nerve cells situated in the gray matter beneath the floor of the fourth ventricle. From this they pass forward and emerge from the side of the medulla, between the facial and acoustic nerves, as the 'pars intermedia of Wrisberg,' of which they constitute a part. The nerve of Wrisberg accompanies the facial as far as the geniculate ganglion, but then leaves it to pass forward to the sphenopalatine ganglion as the great petrosal nerve. In this way, the impulses discharged by the central cells are transmitted by the nerve of Wrisberg and the great petrosal to the cells of the sphenopalatine ganglion, which, in turn, discharges impulses that are distributed in a spraylike manner to the glands and muscular walls of the arterioles. Experiment has shown that if the great petrosal nerve is exposed and divided, and the peripheral ends stimulated, we get a dilatation of the blood vessels and a discharge of secretion from the glands of the mucous membrane of the nose and associated structures. The great petrosal nerve, therefore, contains both secretomotor and vasodilator fibers.

The degree of contraction of the blood vessels of the nasal mucosa is regulated partly by vasoconstrictor nerves, which also consist of two consecutively arranged neurones, and, therefore, belong to the autonomic system. The peripheral neuron arises in the superior cervical ganglion, from which postganglionic fibers pass upward and assist in the formation of the plexus on the internal carotid artery. At the point where the great petrosal nerve crosses this artery, some of the sympathetic fibers (deep petrosal nerve), enter its sheath, and,

passing forward as the Vidian nerve to the sphenopalatine ganglion, accompany its branches to their termination in the blood vessels. The preganglionic fibers originate in the cells of the general vasoconstrictor center beneath the floor of the fourth ventricle. From this the fibers descend the spinal cord to pass out in the ventral roots of the upper thoracic nerves, and thus reach the vertebral chain of sympathetic ganglia to pass upward to the superior cervical ganglion. There is thus a rather circuitous pathway between the vasoconstrictor center and the blood vessels of the nasal mucous membrane. Experiment has shown that if the cervical sympathetic cord be divided, the blood vessels of the nasal chamber will markedly dilate for some days. If the peripheral end of the divided cervical sympathetic cord is stimulated, the blood vessels at once contract. It will thus be seen that the blood supply of the nasal mucosa is under the control of two antagonistic groups of nerves—dilator and constrictor. The caliber of the vessels at any moment is the result of the relative degree of activity of these two groups.

THE CENTRAL MECHANISM.

The nerve cells of the two groups—vasodilator and vasoconstrictor—possess a certain degree of tonicity. They may be excited or inhibited by nerve impulses (1) transmitted from the nasal chambers by the nasal and other branches of the trigeminal nerve, and from the skin by the cutaneous nerves (reflex or peripheral stimulation); (2) descending from the cerebrum in consequence of psychic state of an emotional character (direct or central stimulation). If the tonus of the central mechanism is impaired by changes in its nutrition, peripheral causes, which at one time would produce little or no effect, now give rise to profound and distressing symptoms.

THE AFFERENT NERVE MECHANISM.

The afferent nerve mechanism is found to be in the branches of the trigeminal nerve. The cells of the semilunar (Gasserian) ganglion give origin to a short process, which soon divides into two branches, one of which passes centrally, the other peripherally. The central branch forms the large, or sensory, route. The peripheral branches constitute the three main divisions of the nerve. The axons of the central branches,

after entering the pons, ultimately arborize around the vaso-inhibitor and vasoconstrictor and secretomotor centers. The peripheral branches pass forward to be distributed to the skin, mucous membrane and other structures of the head and face. Other central branches arborize around the 'sensor end nuclei,' the axons of which pass upward to arborize around sensory nerve cells of the cerebral cortex. Stimulation of the first group calls forth reflex phenomena; stimulation of the latter group produces pain.

PERIPHERAL STIMULATION OF THE CENTRAL MECHANISM.

The stimulus to the peripheral termination of the nasal branches of the trigeminal nerve is the variation in the temperature and moisture of the air. The amount of heat radiated from the blood and the amount of secretion produced by the glands ought to vary with the varying temperature and moisture of the inspired air. The reactive adaptation of the individual varies with his age, sex, occupation, habits, stability of his nerve centers and the functionability of his nasal mucous membranes. If a fairly normal individual be subjected to a temperature of 60° F., it will be found that the blood vessels of the nose will possess a certain caliber, the result of the co-operative action of the vasodilator and vasoconstrictor nerve centers. This caliber will permit the passage of a definite volume of blood with a definite velocity in a unit of time, carrying with it a certain volume of heat. If the external temperature should fall to 30° F., the arterioles of the nasal mucous membranes contract as the result of the now predominant action of the vasoconstrictor center, due to the stimulation of the afferent nerve endings by the cold air. At first, this would appear to diminish heat radiation, but it must not be forgotten that though the thickness of the blood stream is diminished its speed is increased, so that the temperature of the air is correspondingly raised. On the other hand, should the external temperature be raised to 90° F., the blood vessels will dilate, the thickness of the blood stream will be increased, and its speed diminished. With regard to the secretory mechanism, similar statements may be made."

So far, we have considered reflex manifestations with a normal nasal mucosa and nerve mechanism. It should follow log-

ically that increased stimulation would result in increased reflex activity—i. e., sneezing and hypersecretion. But what about the reaction in case of a degenerated mucosa? In hyperplastic ethmoiditis with polypoid degeneration, it has been observed that the mucosa fails to contract with ordinary stimulation, and instead of the normal temporary hypersecretion a chronic serous drainage has been noted. Sneezing, on the other hand, was exaggerated. This could be accounted for by the fact that in sneezing, the reflex arc involved the vagus, innervating a normally functioning diaphragm and respiratory musculature. Then, with chronic irritation of the nasal branches of the trigeminal nerve and continued failure of functional activity of the polypoid nasal mucosa, would it not be reasonable to expect an exaggerated reflex activity of the lower respiratory apparatus—i. e., increased sneezing attacks, coughing, hypersecretion of the bronchial mucosa and bronchial spasm? Just why every case of hyperplastic ethmoiditis with decreased functional activity of the nasal mucosa and increased sneezing has not developed some evidence of bronchial spasm has not been explained. It would seem easier to explain why certain cases have developed paroxysms of bronchial spasm. In most of the cases classified as reflex asthma, the individuals were of a neurotic type and exhibited other evidences of nervous instability. Fraser has shown that,¹⁸ "If the tonus of the central mechanism is impaired by changes in its nutrition, peripheral causes, which at one time would produce little or no effect, now give rise to profound and distressing symptoms." Some have gone so far as to express the possibility that such a derangement of the nervous system might have been due to abnormal functional activity of the ductless glands. Rackemann,¹⁷ in 1921, said, "There is for each case of asthma an underlying basis, the nature of which is quite unknown." Since then he has come to have associated with him in this work a very competent rhinologist, who last year presented before this society an excellent study on²⁰ "Vasomotor Disturbances of the Nasal Mucous Membranes." Both these men, in conversation with the writer, have said that a number of their cases were unquestionably reflex in nature and seemingly related to pathology of the upper respiratory tract. The writer has, in carefully classified reflex asthmas with hyperplastic

ethmoiditis and without focal infection, noted relief from asthmatic attacks, following exenteration of the ethmoid, varying from comparative comfort with mild attacks in sudden changes of weather to a complete cessation of attacks. Five such cases have remained absolutely asthma free to date, matters or two to four years. The crux of the whole situation has seemed to be a definite classification of cases before treatment was attempted.

Summarizing, the extrinsic, being due to causes outside the body, notably pollen asthmas, have not concerned the rhinologist.

The intrinsic, whether due to bacterial toxins from focal infection or resulting reflexly from pathology of the respiratory tract, have concerned the rhinologist, and every case has been subjected to careful study and classification before treatment was instituted.

Probably the most valuable observation, to the writer, developed in five years' study of this problem, has been that he has found his efforts at treatment productive of results directly in proportion as he has confined his activity to the intrinsic group and classified them as bacterial or reflex before either attacking foci of infection or attempting the correction of pathology factoring in the production of reflex bronchial spasm.

DIAGNOSIS.

The diagnosis of asthma is made by the patient. In the cases studied by the writer, the diagnosis has been confirmed by the internist referring the case, and when seen by the rhinologist has been accepted without question. Rhinologic diagnosis has consisted of, first, a correct classification (extrinsic or intrinsic, and, if intrinsic, bacterial or reflex), and second, finding the exciting cause. Data for diagnostic purpose has been developed from the history and rhinologic examination as follows:

I—RHINOLOGIC HISTORY

A. Family.—Seventeen per cent of writer's series reported asthma in other members of the family. Rackemann found family history of asthma in extrinsic cases 58.7 per cent, and intrinsic 10.5 per cent.

B. Personal.—Forty-two per cent had asthma less than five years. Fifty-eight per cent, more than five years. Twenty per cent, since childhood.

C. Age at Time of Examination.—Oldest, 73 years; youngest, 2 years; average age, 36 years. Seventy-eight per cent were between 20 and 60 years.

D. Age at Onset of Asthma.—Oldest, 61 years; youngest, 2 years; average age, 26 years (Rackemann found average age for extrinsic 12 years, and for intrinsic 26 years). Seventy-two per cent were between 10 and 40 years; 38 per cent were between 20 and 30 years. Age of onset of cases relieved by treatment: Oldest, 57 years; youngest, 21 years; average, 32 years. Seventy-seven per cent had onset between 20 and 40 years.

E. Other Allergic Reactions.—Two cases had eczema. Two other cases had urticaria. Five cases had hay fever.

F. Skin Tests.—Nine per cent of cases showed positive skin reaction to some foreign protein (pollens). Results of treatment in these cases are least satisfactory. Only two cases were relieved, three were improved. Most positive cases were examined and not treated.

G. Season of Attack.—Twenty-seven per cent of cases had attacks only in winter; 19 per cent, summer and autumn; 54 per cent, all seasons. Intrinsic cases are usually winter or all seasons.

II—RHINOLOGIC EXAMINATION.

A. Cervical Glands.—Note was made of location, palpability, size and consistency of glands.

B. Mouth and Pharynx.—Note was made of condition of gums, teeth, probability of root abscesses. Tonsil pillars compared in appearance with mucous membrane of the adjacent buccal surface, palate and gums. Posterior pharyngeal wall was noted as smooth or granular; showing dilatation of veins or patches of lymphoid tissue, especially behind the posterior pillars. Tonsils were noted as pale or congested; prominent or buried; cryptic, smooth or scarred. Nature of material expressed by firm pressure against the anterior pillar was noted as cryptic débris or pus.

C. Nares.—Breathing space noted as ample, narrow or obstructed. The left naris compared with the right, as having relatively increased or diminished air space. Mucous membrane of the nares noted as pale or congested or edematous, clean or bathed in secretion. Note was made of degree of deflection and points of contact with turbinates.

Nose then shrunk with fine spray of 1 per cent cocain, and note made of any delay or failure of the mucous membrane to blanch and contract as result of this stimulation. Ten per cent cocain applied with cotton applicator to free margins of middle turbinates, and the area of the sphenopalatine foramen, and note made of any hypertrophy of turbinates, or polypoid degeneration of mucosa in the ethmoid region. Further examination was made with the nasopharyngoscope. For this purpose, the writer has employed a specially made No. "9-F" size scope with corrected image, which is found to be much superior to the No. "12-F" size ordinarily used, especially in getting beneath the middle turbinates and into the vault of narrow nares. Note made of the location and probable source of any drainage and the condition of the mucous membrane of the posterior nares and nasopharynx. Congestion, secretion or scarring in the adenoid area, together with size of any adenoid mass present noted. The ostia of the eustachian tubes noted as patent or obstructed.

D. Paranasal Sinuses.—The condition of the ethmoid noted in examination of the nares. Frontals and antra were transilluminated with the nasopharyngoscope and any inequality of light transmission carefully observed by increasing or decreasing the intensity of the light. Dark or cloudy antra were washed and results noted. Antra, cloudy on transillumination but returning a clear water on washing, were considered as showing evidence of hyperplasia of the mucosa and their possible etiologic relation to the asthma considered.

E. Ears.—Ears were examined for evidence of irritation of the canal (reflex cough), retraction, perforation or scarring of the drum. Hearing tested to note presence of catarrhal otitis media.

F. Summary of nose and throat findings was made under headings:

1. Focal infection of tonsils, sinuses, teeth or ears.
2. Evidence of causes of reflex disturbance—hyperplastic ethmoiditis, mechanical pressure between septum and turbinates, and any evidence of vasomotor rhinitis.

Following a careful check of the nose and throat findings with those of the internist's examination, opinion was given relative to the classification of the case as (1) extrinsic, or (2) intrinsic asthma, and if intrinsic, bacterial or reflex. The probability of nose and throat pathology being a causative factor was stated.

TREATMENT.

Extrinsic asthmas were advised against entering upon any program of nose and throat treatment with the expectancy of relief from asthma. Removal or treatment of foci of infection developed by the examination was advised, as in any case suffering from focal infection, but not as a means directed to the relief of asthma.

Nose and throat treatment of intrinsic asthmas was directed to the removal of foci of infection in bacterial asthma, and the correction of nasal defects that seemed to be a factor in production of reflex asthma.

A. Removal of Foci of Infection.—The most common foci of infection developed in the nose and throat examination were, of course, the tonsils and teeth. Diseased tonsils and adenoids were removed, and the mouth cleaned up by a dentist. An observation of notable interest in some of the cases of chronically infected tonsils, with marked passive congestion of the anterior pillars, was that pressure on the anterior pillars made during the examination for expression of pus would precipitate an attack of bronchial spasm, instead of the mild retching usually produced. In certain cases, in which the asthma disappeared immediately following the removal of tonsils and did not return, the interesting question develops as to whether the asthma resulted from toxins incident to the infection in the tonsils or whether it occurred reflexly from irritability of the afferent sensory nerves of the palate and pharyngeal pillars, the infected tonsils having simply acted as a cause of their congestion and irritability.

Foci of infection in the form of chronic suppurative ethmoiditis, or empyema of the frontal and maxillary sinuses, were given the benefit of radical operation. The Mosher operation, slightly modified by use of the Kohler punch, was employed exclusively in the exenteration of ethmoids. Suppurative antra were washed five to ten times, and, if persistent, the Caldwell-Luc operation was done. While considerable has been written regarding suppurative antra as a cause of asthma, and cases have been reported to have been relieved of asthma by cleaning up the suppurative focus, the writer has obtained less satisfactory results, so far as the asthma is concerned, than he had expected. In no case has he failed to obtain a clean antrum following the Caldwell-Luc operation, but the asthma, which would seem to be improved for a time, usually returned in five or six months. Exenteration of suppurative ethmoids has given better results, but even then no such complete relief from asthma followed as was observed following the exenteration of nonsuppurative chronic hyperplastic ethmoids.

B. Correction of Nasal Defects.—Considerable space in this thesis has been devoted to a review of the anatomy and physiology of nasal reflexes, and to the argument of reflex bronchial spasm resulting from stimulation of the afferent fibers of the trigeminal nerve in the nasal mucous membrane. This study was prompted by the observation, following the double exenteration of the ethmoids in cases of chronic hyperplastic ethmoiditis, of the complete and lasting relief from asthma that resulted. Furthermore, several cases examined during acute asthmatic attacks were observed to experience a cessation of dyspnea and asthmatic symptoms immediately following shrinkage of the ethmoid area with cocaine. Attempts have been made to improve the ventilation of the ethmoid region and remove sources of chronic irritation.

Middle turbinates, hypertrophied and in contact with the septum, were removed. Lower turbinates, in contact with the septum and obstructing breathing space, were fractured outward, but never removed in any part except for the removal of polypoid posterior tips.

Septum deflection and spurs were corrected by submucous resection, when necessary to gain space for ethmoidectomy or to remove a sharp spur in contact with the lower turbinate.

In no case was resection of septum alone employed as a means of relieving asthmatic attacks.

Ethmoids, showing polypoid degeneration of the bulla, were completely exenterated by the Mosher method. Complete and clean exenteration has given eminently better satisfaction than is believed could have been obtained from simply opening the cells, as advocated by some operators. The only excuse for such superficial tampering in a nonsuppurative hyperplastic ethmoiditis would seem to be fear engendered by a lack of knowledge of variations in size and arrangement of the ethmoid cells, and anyone who has been put through the sprouts of Dr. Mosher's course on the anatomy of this area should never find himself lost or in serious doubt of his orientation.

Polyps have been removed, experimentally, but no lasting result was noted until the degenerated tissues of which they were but pendulous masses had been removed by exenteration of the ethmoid.

Cauterization has not been employed in any of these cases.

C. Removal of Foreign Bodies from Bronchi.—Two cases, not included in this series, developed acute asthmatic attacks following the inhalation of foreign bodies into the trachea. One of these cases developed attacks of bronchial spasm immediately following the extraction of teeth, and for over a year severe attacks developed on slight exertion, especially on walking uphill. Finally, patient coughed up a tooth root, and attacks promptly ceased. Second case was relieved by removal of foreign body by bronchoscopy.

D. Nonoperative Treatment.—Several cases of asthma have been observed, particularly in children or young adults, in whom the asthmatic attacks seem to follow acute head colds. These individuals, though their tonsils have been removed and teeth are well cared for, seem to suffer from head colds following the least exposure in inclement weather. Between attacks their nares appear to be clear and free of evidence of infection. Some of these cases may be typical cases of vasomotor rhinitis, but others would appear to develop acute nasal infection. These asthmatics responded quickly to nonsurgical treatment. Treatment consisted of shrinking of the nasal mucosa with a spray of 1 per cent cocaine, followed by a thorough

cleansing of the nares and nasopharynx with an alkali spray. In some cases adrenalin packs were inserted between the middle turbinate and septum for a few minutes. On relief of the asthmatic attack, they were sent home to bed and kept at complete rest for from forty-eight to seventy-two hours under the management of the family physician.

Various methods of antiseptic treatment have been tried. The Dowling pack, so highly praised by Haseltine, has been tried, but has been found less satisfactory in our hands than the method advocated by Dr. Skillern, consisting of a fresh solution of a 6 grain capsule of neosilvol, in 1 dram of warm water, applied on cotton pledgets to the ethmoid area, and allowed to remain in place for one-half hour, during which time the patient rests in a recumbent position.

For children, it has seemed as satisfactory to drop in each nostril about five drops of adrenalin, 1/1,000, the child being in a recumbent position, with head well back, and after fifteen minutes allowed for shrinking effect of adrenalin, to insert ten to fifteen drops of a freshly prepared 10 per cent neosilvol solution in the nose. The advantage of the Skillern method would seem to be in the fact that the gelatin of the capsule, which is dissolved with the silvol in the warm water, tends to congeal at the body temperature and hold the silver salt longer in contact with the mucous membrane than an aqueous solution would be held. All such procedures find their usefulness pretty largely confined to the relief of acute attacks. Two children having nonoperative treatment regularly repeated for a number of weeks resulted in complete relief from attacks without recurrence to date.

E. Vaccine Treatment.—In some cases studied, the internist followed the removal of the focus of infection by a course of vaccine. All tonsils removed are routinely sectioned and examined by a competent pathologist, and cultures made when requested. Cultures of hemolytic streptococci and staphylococci thus developed have been used by the internist in some cases for a vaccine. In other cases stock vaccines have been used. The effect of such vaccine treatment upon the course of the asthma has not been sufficiently studied to warrant a report.

Some cases that have been asthma free following removal

of tonsils and adenoids have had vaccines, but more have not had vaccines.

About 100 cases have been examined and classified, but for purposes of this study, it has seemed best to eliminate, first, hospital staff cases, because on discharge from the hospital they are soon lost sight of, and questionnaires are either ignored or furnish data so unreliable as to render worthless any classification or deduction that should include these cases; second, cases classified as extrinsic asthma, because treatment of these cases is considered by the writer as not properly the work of the rhinolaryngologist.

Data of examination findings has been developed from 62 cases. Data of results of rhinologic treatment of intrinsic asthma are based on a study of fifty private cases. The time elapsed since operative treatment was performed in these cases varies from one to five years.

RESULTS OF TREATMENT IN FIFTY CASES OF INTRINSIC ASTHMA.

TREATMENT	Number Treated	Completely Relieved	Improved	Unimproved
Tonsillectomy alone.....	15	3	11	1
Tonsillectomy and septum resection	2	1	1	—
Tonsillectomy and ethmoidectomy	11	6	5	—
Tonsillectomy, ethmoidectomy and septum resection	9	2	6	1
Ethmoidectomy alone.....	8	3	5	—
Ethmoidectomy and septum resection.....	1	1	—	—
Septum resection alone.....	None	—	—	—
Nonoperative treatment	4	4	—	—
Total	50	20	28	2

In the above tabulation, both unimproved cases exhibited definite evidence of an extrinsic cause. A single instance of recurrence of asthmatic symptoms was considered sufficient to exclude the case from the "completely relieved" and include the case under the heading "improved," even though the patient was well satisfied with complete relief except for a mild wheezing accompanying acute colds. All the above were private cases. No case has been under treatment within one year. All cases were checked up as late as October, 1925, with a questionnaire.

CASE REPORTS ILLUSTRATIVE OF RESULTS OF VARIOUS FORMS OF RHINOLOGIC TREATMENT.

I—TONSILLECTOMY ALONE.

A. Unimproved.—This case included to illustrate a confusion of extrinsic with intrinsic asthma, which occurred early in the study.

Mrs. E. P., examined July 25, 1921, age 25, age at onset 15. Complaints of asthma, attacks at first lasting from one-half to one day, occurred mostly in summer. Recent years occur any season. Recent attack lasted two weeks. Family history negative. Chest negative between attacks. Skin tests positive for spring grasses.

Examination: Cervical glands palpable. Teeth clean and in good repair. Tonsils large, cryptic, left deeply buried, both tonsils infected. Pillars and uvula congested. Posterior wall showed dilatation of all blood vessels. Anterior nares wide open, septum shows spur low down on right, firmly pressed against inferior turbinate and deviated to the left in contact with left middle turbinate, and posteriorly, to right, high up against right middle turbinate. No pus in either nostril; small mass of congested adenoid tissue. Frontals and antra clear. Ears negative, hearing normal. Advised to have desensitization treatment for grass pollens and removal of focus of infection in tonsils and adenoids, for its possible effect upon the attacks occurring in the winter. August 31, 1921, tonsils and adenoids were removed under general anesthetic. September 1, 1925, no winter attacks since removal of tonsils, but mild attacks of hay fever each spring and some asthma during the summer.

B. Improved, Bacterial Asthma.—Mr. R. D., examined January 15, 1923, age 19, age at onset 4. Family history negative. Asthma occurs following acute colds, and troublesome all winter. Examination: Cervical glands palpable. Teeth good. Tonsil pillars and uvula red and edematous. Tonsils flat, scarred, pus expressed from both. Posterior wall red, covered with lymphoid tissue. Septum fairly straight, good breathing space. Both middle turbinates show beginning polypoid degeneration along margin, left worse than right. Frontals and right antrum clear, left antrum cloudy. No pus in nares. Posterior nares congested. Fairly large mass of edematous

adenoids. Ear drums retracted, but hears low tones normally. Advised removal of tonsils and adenoids, and later, if necessary, surgical treatment of the polypoid condition of turbinates, especially in the left nostril. January 19, 1923, tonsils and adenoids removed under general anesthetic. February 2, 1923, tonsil fossæ healed, no asthma, patient to report for treatment of nose if asthma should return. October 1, 1925, has had no further work done and reports marked improvement; says that sometimes in quick change from warm to cold weather is bothered some, but not to amount to anything.

C. Relieved, Bacterial Asthma.—Mr. G. S., examined February 23, 1921, age 61, age at onset 31. Had hay fever for 30 years. A year ago, hay fever was followed by asthma, which recurred this year, and has been very severe. Family history negative, chest clear. Skin test slightly sensitive to ragweed. Examination: Cervical glands palpable. Tonsil pillars very congested, tonsils atrophied, scarred, quantity of pus and foul secretion in both tonsils. Septum straight; both middle turbinates polypoid, right worse than left. Frontals and left antrum clear. Right antrum cloudy. No pus in nose. Ears negative. Advised that hay fever was a problem for the internist, but recommended removal of tonsils and polypoid middle turbinates for possible improvement in the winter asthma. September 16, 1922, patient declined operative treatment, but was seen repeatedly during the spring and fall of 1921 and 1922, and says that asthma has been much relieved by the shrinking of the nares. Has just had some severe attacks of hay fever, and has decided to have tonsils removed under general anesthetic, and polyps removed from right nostril. October 1, 1925, patient has returned for observation several times each year since tonsillectomy. Has had no return of asthma within three years, and no hay fever in 1924 or 1925. This case, though slightly sensitive to ragweed, would seem to have had the exciting cause for his asthma closely related to the bacterial infection of tonsils.

II—TONSILLECTOMY AND SEPTUM RESECTION.

A. Relieved, Bacterial Asthma.—Mrs. J. R., examined January 15, 1913, age 44, age at onset 35. Attacks began with difficult breathing, coughing and huskiness of voice. This was

followed shortly by asthmatic attacks, which increased in frequency and severity. Family history negative, chest clear. Examination: October 26, 1913, by Dr. A. G. M., shows tonsils fairly large and slightly infected. Small mass of scarred adenoids: Right inferior turbinate very large, extending to the left beyond the middle line, and fitting into the concavity in the septum, which is deviated to the left in close contact with left middle turbinate. Right middle turbinate also hypertrophied. Spur on left of septum, posteriorly, in contact with left lateral wall. Sinuses clear. Larynx normal. Hearing diminished on left. Hears watch sixteen inches on left, six feet on right. April 16, 1915, removed right middle turbinate. May 4, 1915, submucous resection of septum. Examination on May 23, 1918, shows trouble in tonsils. Advised removal. April 14, 1920, tonsils removed under local anesthetic. January 15, 1923, seen because of slight dyspnea following acute cold. Examination shows no evidence of asthma, throat clean, nose clear but congested from acute cold. Patient states she has had no asthma since removal of tonsils. Patient reports: "My asthma disappeared after removal of infected tonsils and three infected teeth in 1920. I am now perfectly well, can swim, walk, etc., and am much less nervous than formerly." Note—This case, the wife of a physician, was carefully studied by a number of men, and is here reported as bacterial asthma, showing little improvement following correction of nasal defects, and complete relief following removal of tonsils.

III—ETHMOIDECTOMY ALONE.

A. Relieved, Reflex Asthma.—Mrs. H. F., examined August 5, 1924, age at onset 45. Complains of asthma which developed a year ago, following throat trouble, when she was in the West, where she had considerable nose and throat treatment. Family history negative, chest normal. Has had gall bladder operation, and a gastric ulcer removed. Skin tests negative. Asthma began late in August and continued until March, recurring attacks since. Examination shows tonsils well removed, throat clean. Larynx normal. Septum straight, but upper nares blocked by polypoid degeneration of both ethmoids. Right middle turbinate is large and tightly wedged between septum and lateral wall. Left middle turbinate shows

anterior half removed, remaining portion and bulla a mass of polypoid degeneration. Recommended double exenteration of ethmoids. August 7, 1924, radical exenteration of right ethmoid. October 27, 1924, no asthma since operation. January 7, 1925, exenteration of left ethmoid. October 1, 1925, patient reports entirely relieved up to the present time. This patient is a highly intelligent woman, and her comment in the questionnaire is herewith given as illustrative of one phase of a truly reflex asthma. She states: "My asthma might have started earlier than above stated, but was slight, and gradually grew worse; never really recognized it as asthma until August, 1923. Always had difficulty in breathing in cold, damp weather when out of doors and exercising. In 1919 and 1920, in Iowa, I had in October what I now believe to have been asthma followed by intestinal trouble. The attacks in 1923 and thereafter were always accompanied with intestinal trouble. Have had no trouble since operation." Consideration of all the facts in this case leads to the opinion that with the development of the hyperplastic ethmoiditis the patient developed mild reflexes in the form of dyspnea, when exposed to cold, damp air. As the nasal blocking progressed and peripheral stimulation increased, the reflexes became more marked up to the point of vagotonia, as evidenced by severe attacks of bronchial asthma and intestinal disturbance. Whatever may be the underlying basis of such a condition, it would seem that the exciting cause lay in a peripheral irritation within the nose and failure of a hyperplastic ethmoid to respond normally to such reflex irritation.

B. Relieved, Reflex Asthma.—Mr. G. L., examined February 11, 1925, age 66, age at onset 57. Family history negative, chest clear. Patient exceptionally rugged and healthy (occupation, carpenter), but suffering from very severe attacks of asthma, which began about eight years ago, and have increased in frequency and severity until he is hardly free for a day. Examination: Cervical glands palpable; teeth artificial; palate moderately congested; tonsils atrophied, no pus expressed. Septum quite irregular, with crest along base on left and ulcer on right side of cartilage. Both middle turbinates in contact with septum; left is large and cystic, filling in a concavity in the septum. Right middle turbinate smaller, pale in

color and entire ethmoid area polypoid. Frontals and right antrum clear, left antrum slightly cloudy. Pharyngoscope shows polypoid degeneration throughout the exposed part of the right ethmoid and the posterior part of the left middle turbinate. Small polypoid mass protrudes from the osteum of the left sphenoid. Ear canals clear, drum retracted, watch heard at three feet in the right and at contact in the left. Classification, intrinsic asthma, reflex type. Performed exenteration of both ethmoids and left sphenoid. April 22, 1925, patient last seen at office, asthma free and in excellent health. Nares clean, no drainage or crusting. October 1, 1925, patient reports in questionnaire as a result of treatment, "Relieved." Also comments as follows: "I am feeling fine, sleep well, eat well, am gaining in weight and drink whenever I can get anything. I wouldn't take a thousand dollars to be back the way I was before the operation."

IV—RESECTION OF SEPTUM, ETHMOIDECTOMY AND TONSILLECTOMY.

A. Relieved, Bacterial Asthma.—Miss A. C., examined September 20, 1922, age 45, age at onset 40. Complaint, asthma five years; starts usually in March and continues to July or August. Has been repeatedly examined and has had all teeth extracted. Family history negative. Chest clear. Skin tests negative. Examination: Cervical glands palpable. Tonsils fairly large, filled with cryptic material; pus expressed on firm pressure. Septum deflected to left above, occluding left naris. Left middle turbinate bathed in mucopurulent secretion. Right middle turbinate hypertrophied, mucosa thickened, shows polypoid degeneration throughout. Small mass of inflamed adenoids. Frontals and right antrum clear, left antrum hazy. Classification, intrinsic, probably bacterial, asthma not having developed until age of 40. Advised removal of tonsils and adenoids; later, if necessary, correction of nasal defect. October 9, 1922, tonsils and adenoids removed under general anesthetic. March 5, 1923, patient reports no asthma since tonsils were removed, although in previous years attacks were noticed by March. May 18, 1923, asthmatic attacks returning, rather severe attack this past week. July 11, 1923, submucous resection of septum, exenteration of right ethmoid. At

operation patient reported a severe attack of asthma, having sat up in chair all preceding night. December 5, 1923, patient has been free of asthma since operation. Is going to California for the winter. September 12, 1924, reported for observation, having recently returned from California, where she was asthma free. March 14, 1925, reported for observation following an acute cold, during which she noted some dyspnea but no true asthma. October 1, 1925, patient reports complete relief from asthma for past two years.

V—SEPTUM RESECTION AND ETHMOIDECTOMY.

One case listed thus because operative treatment included septum resection, which was done to facilitate performing the ethmoidectomy, should probably be included under ethmoidectomy. The complete relief of asthma which followed the operation resulted from the ethmoidectomy rather than from the septum resection.

VI—SEPTUM RESECTION ALONE.

No cases. The writer has failed to observe any cases of asthma in which irregularity in the septum alone was considered a sufficient exciting cause.

VII—NONOPERATIVE TREATMENT, BACTERIAL ASTHMA.

Four cases. Two adult women, aged 57 and 48, classified as bacterial asthmas, with foci of infection in tonsils, declined operation, but have been free of severe attacks since having tonsils thoroughly cleaned and reporting for palliative treatment, as outlined above, whenever any acute condition in the throat seemed to develop.

Two children. One, a boy, aged 13, presented a nose almost completely blocked, with hypertrophied turbinates and complaining of severe asthmatic attacks following acute colds in the fall, which recurred off and on throughout the winter, was treated with shrinking and silvol packs during the winter of 1923, and had no recurrence during 1924. He has not been seen in over a year, and no reply was received from questionnaire, but his father reports: "No asthma since treatments in 1923." The other, a girl, aged 11, whose age at onset was 9, examined November 12, 1921, had severe attacks of asthma,

winter and summer, whenever she caught cold. No history of hives or eczema. No hay fever. Family history negative, chest negative. Skin tests negative. Tonsils removed at age of 9, and her physician reports no improvement to have followed. She subsequently had seven injections of bacterial vaccine, following which she had no attacks for eight months. Examination: Tonsil fossæ clean; posterior wall congested and granular. Teeth good. Both nares bathed in purulent secretion. Right inferior turbinate hypertrophied; septum thickened above; both middle turbinates inflamed and bathed in mucopurulent secretion. Patient was treated by shrinking with cocain, followed by silvol packs every two weeks until June. Patient remained asthma free after the first month of treatment. She was treated once in October, and once in November of 1922, at the onset of acute colds, and was last seen January 27, 1923, when she reported that she had been free of asthma for two years. October 1, 1925, in response to questionnaire, patient gives her present age as 15, age at onset 9, result of treatment "relieved" and comments "perfectly well." These last two cases are rather striking examples of what can be accomplished by nonoperative treatment of ethmoiditis in children.

SUMMARY.

Review of the literature has shown increasing development, during the past decade, in the study and treatment of the exciting cause of bronchial asthma.

Assuming asthma to be a symptom and never a disease, and for each case an underlying basis, the nature of which is unknown, recent studies of the exciting causes have developed distinct types, classifiable into two main groups: extrinsic, where the cause is outside the body, and intrinsic, where the cause is within the body. The intrinsic has been further divided into bacterial and reflex groups.

Extrinsic asthmas are not within the function of the rhinologist for study or treatment.

Intrinsic asthmas, comprising from 50 to 60 per cent of all asthma cases, have been shown to depend largely upon lesions of the respiratory tract for exciting causes. The bacterial group, with foci in tonsils, teeth or bronchi, has been much

written about by recent investigators, is quite generally understood, and has seemed to admit of little further discussion. The reflex group, perhaps less understood, has seemed to warrant a rather detailed review of the nerve reflexes involved, as offering the most logical explanation of a certain type of bronchial asthma that has repeatedly been observed to promptly and permanently disappear following the correction of causative sources of irritation within the nares, notably in hyperplastic ethmoiditis.

Rhinologic treatment of asthma has been productive of results directly, as it has been confined to intrinsic cases. Whether directed to the removal of foci of infection in the nose, throat and bronchi in bacterial asthma, or to the correction of nasal defects in reflex asthma, the results obtained have compared favorably with those reported from any other form of treatment. Results, such as herein reported, of 40 per cent completely relieved, 56 per cent improved, and only 4 per cent unimproved, would seem to warrant the serious consideration, by rhinologists, of this problem of affording some measure of relief to the ever increasing number of patients afflicted with this distressing condition.

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XXXIX.

UNUSUAL TYPES OF MASTOIDITIS, WITH PRESENTATION OF PATIENTS.

By S. MACCUEEN SMITH, M. D.,

PHILADELPHIA.

When you hear the brief histories and see the patients I have to present to you this evening, you may think that these cases are not unusual, after all, and that the title of my discussion is, therefore, a misnomer, from the fact that a great many of our cases of surgical mastoiditis, especially during the past few years, are atypical, and yet I believe that these are of sufficient interest to warrant my presenting them here this evening.

Except in a very few instances, in which mastoiditis develops from trauma or a metastatic focus is established from infection carried through the blood stream or lymphatics, it is conceded that this disease is secondary to and caused by infection involving the mastoid by way of the eustachian tube and tympanic cavity. It is well to keep in mind the pathologic changes that take place incident to swelling caused by inflammation of the mucosal lining of the middle ear cavity, and more especially of the tympanic folds, which frequently divide this space into two separate parts. In an otitis media in which the tube remains patulous and the inflammation is confined within the limits of the membrana tensa, the mastoid is not apt to become seriously involved. On the other hand, when the inflammatory process invades the vault and its communication with the lower part of the cavity is sealed off by the swelling of the tympanic folds, and more especially if this process becomes suppurative, the mastoid is always implicated, as these spaces are part and parcel of the same cavity. In other words, the development of surgical mastoiditis, especially when the vault is involved, depends almost wholly on the establishment

*Read before the Section on Otology and Laryngology of the College of Physicians in Philadelphia, December 15, 1926.

of prompt and efficient drainage, the virulence of the infection, the resistance of the patient and the composition of the osseous structure.

The diagnosis of mastoid disease is a most inclusive subject, and it is not my purpose to enter into this general phase of the question. I do wish, however, to call attention to the proper consideration of the osseous structure in diagnosing the presence of surgical mastoiditis. In middle and old age the mastoid cortex is even extremely sclerotic, and I have noticed this also in young adults and even in children suffering from a chronic otorrhea extending over several years. Under such circumstances the cortex is dense and thick, which precludes external perforation. Intracranial complications are, therefore, the natural outcome of inflammatory extension, as the disease follows the line of least resistance towards the interior of the skull. It will be readily observed that this condition, owing to the retention of pus, is much more serious and more urgently requires energetic treatment than those presenting the visual or classical symptoms of mastoiditis.

The diagnosis of acute mastoiditis is simple enough when there is a history of acute tympanic suppuration extending over a period of two or more weeks, with a rise in temperature, even though slight, in spite of the continuance of a more or less profuse discharge. If, in addition, there is some headache, which need not necessarily be on the affected side, drooping of the superior posterior osseous wall adjacent to the tympanic ring and a gradually developing tenderness on pressure and swelling over the mastoid process which is not caused by furunculosis, the diagnosis is quite evident.

I consider the continuation of fever accompanying acute suppurative otitis media, especially if the discharge is abundant, and more particularly if this occurs in an adult, as a grave sign and an urgent indication for operative intervention, in the average case, even in the absence of other characteristic symptoms. This, however, does not negative the existence of surgical mastoiditis in the presence of a normal temperature and a free otorrhea.

In those cases where symptoms of mastoiditis appear or recur after the cessation of discharge, surgical interference should be considered as immediately needful.

In some cases of mastoiditis the membrana tympani remains intact, and its color may be but little changed from the normal. The external auditory canal in such instances is usually more or less swollen, even to the extent of obstructing a view of the membrana tympani. In other words, a narrowing of the external auditory canal, when not due to furunculosis, is an indication of surgical mastoiditis.

In sclerotic cases, on account of the resistance offered by the mucosal lining covering the tegmen antri and tympani, absorption of the anterior wall of the antrum and mastoid occasionally occurs, providing for an abundant otorrhea, which escapes from the meatus through a very much contracted opening in the upper posterior wall.

Surgical mastoiditis is present when a copious purulent discharge is present at the end of four or five weeks, even though not accompanied by pain, fever or other local or constitutional symptoms. Generally speaking, the mastoid operation will be required in all cases of acute middle ear suppuration where multiple myringotomy becomes necessary, even in the absence of other characteristic symptoms.

It is those cases in which there is an absence of the usual signs of mastoiditis, such as the classical symptoms and others enumerated above, which at times tax one's diagnostic ability to the utmost.

I have several interesting cases to present to you, the histories of which I will briefly state:

Case 1.—B. L., male, aged 23 years. Prior to his present illness this patient never had any aural disease. About the first of October, 1926, after prolonged swimming and high diving, he felt an annoying sensation in the left ear, which he referred to his teeth and jaw, and consulted a dentist, who found the teeth negative. His physician gave him a series of hypodermic injections "to prevent formation of pus in the jaw." One week later swelling appeared back of left ear, with pain radiating down the neck. He was admitted to the hospital October 9, with pain, swelling and tenderness on pressure over the emissary vein, extending posteriorly almost to the occipital protuberance, and pain over the left eye.

Examination showed* three furuncles, of the superior, anterior and posterior part of the external auditory canal, just

within the meatus, which made it impossible to see the membrana tympani. A blood count at this time gave a leucocytosis of 15,000 and a polymorphonuclear percentage of 87. Temperature 100,° pulse 84, respirations normal. The furuncles were opened without relieving the pain and swelling over and posterior to the emissary vein. The following day the membrana tympani was observable and showed some congestion of Shrapnell's membrane and redness extending down long handle of malleus. There was no other evidence of middle ear disease. The eustachian tube was patulous at this time. The patient thought that his hearing was little if any impaired. Pain and swelling continued during the following two days.

The X-ray report showed no cellular outline on the left side; cellular area hazy but no actual bone destruction in the posterior and inferior cells noted. In the attic region there was an apparent beginning necrosis.

A simple mastoid operation was performed. The cortex was decidedly dense and somewhat thickened. On removal pus escaped under pressure. The cells were broken down, and there was carious erosion exposing the sinus, well covered with a protective coat of granulation tissue, practically from the knee to the bulb. The emissary vein was not exposed, and the edema and tenderness posterior to the mastoid quickly subsided following mastoidectomy.

The next day the leucocytosis was 10,800 and the polymorphonuclear percentage 78. Temperature 99,° pulse 80, respirations normal, the patient making an uninterrupted recovery.

One of the interesting points of this case is that the patient did not have a suppurative otitis media, at least, none shown by otorrhea. Unquestionably, however, the disease originated in the usual way, via the eustachian tube and tympanic cavity, the latter largely recovering themselves, but the mastoid involvement progressively increased. There were but few signs of pathology over the mastoid process, and these could be accounted for as a result of the furunculosis of the external auditory canal. On the day of the operation the patient developed some pain on deep pressure over the mastoid antrum, which would not have appeared if the furunculosis, which

had been corrected, had been the only etiologic factor. This symptom and the blood picture and tenderness over the emissary vein were the chief factors in determining the necessity for mastoidectomy.

Case 2.—J. H. K., male, aged 20 years. Patient never had any ear trouble previous to the present illness, which began in July, 1926, after ocean bathing. Pain on right side of head, starting posterior to and below tip of mastoid and extending over that side of head, lasting four days. Treated by physician, with disappearance of symptoms. About one month later similar pain occurred, but much more severe, accompanied by swelling posterior to the mastoid, almost to the occiput, continuing about one week, under treatment. With the exception of slight occasional pain, patient apparently had recovered for a period of about two months, when severe suffering returned, causing loss of sleep for four days, when he entered the hospital, October 27th.

Examination showed marked tenderness and swelling from line of auricle back to the occipital protuberance, extending over the temporal region and below the mastoid, involving the posterior cervical nodes. Membrana tympani was normal in appearance, so far as could be seen, although mercurochrome had been applied to part of the drumhead, and this prevented a definite statement as to its appearance. The patient did not complain at any time of pain or discomfort in the ear, although the hearing was very much impaired, which indicated mastoid involvement, again occurring in the usual way, through the tympanic cavity via the nasopharynx and eustachian tube. An ice bag was applied constantly for twenty-four hours without relief.

The X-ray examination showed definite clouding of the mastoid antrum and lower cells. Wassermann was strongly positive before and some days after operation. Temperature was 100° on admission, reaching 101.3° that evening and remaining at that point the following morning, but before 1 p. m. it had dropped to 99°. Simultaneously the swelling posterior to the mastoid greatly increased, indicating the escape of pus confined within the mastoid cavity, and this was verified at operation.

The urinalysis was rather negative except for an alkalin reaction and slight cloudiness. A second report the day after operation showed an acid reaction and otherwise fair normalcy.

Notwithstanding the edema over the mastoid process, the cortex did not show actual pathology. Immediately beneath, however, the cells were broken down and well filled with pus and granulation tissue. The antrum was difficult to find on account of some new bone formation. The sinus was exposed for about one-half inch and well covered with granulation tissue. A small piece of bone was adherent to the sinus wall and was allowed to remain lest its removal injure the vessel, which examination indicated to be healthy in its intramural aspect. The necrosis extended well posterior to the sinus, and in order to remove some additional cells and evacuate the fluctuating mass posterior to the mastoid a transverse incision was made.

The temperature remained normal until the fifth day after operation, when the right eye became swollen and almost closed and the temperature rose to 100°. Cold applications reduced the swelling rather promptly and the temperature remained normal or below thereafter.

Blood examination before operation showed a leucocytosis of 20,400 and a polymorphonuclear percentage of 88. Five days after operation the leucocytosis was 9,700 and the polymorphonuclear percentage 79, and three days later, or eight days after operation, the leucocytosis was 9,600 and the polymorphonuclear percentage 63. A specimen from the mastoid wound gave a pure culture of the pneumococcus. The patient made a good recovery and has practically normal hearing.

Again we must assume that the infection originated in the nasopharynx and made its way into the mastoid via the tube and tympanic cavity without producing much pathology in the latter. One month after the onset, as the history shows, the symptoms recurred, abated under treatment, were quiescent for an additional two months and then reached their climax, requiring operative intervention. This part of the history is truly unusual, and yet the necessity for the operation when finally decided upon was quite obvious.

Case 3.—S. F., male, aged 49 years. In June, 1926, this patient developed an abscess of the left ear, without pain, rather promptly recovering under treatment. Buzzing tinnitus

aurium remained. Four weeks later an attack of tonsillitis was accompanied by severe pain in the same ear. A myringotomy was promptly performed, which relieved the pain for three or four days, when a second myringotomy was necessary, and this was followed a few days later by a third myringotomy. The discharge continued, although somewhat lessened in amount.

At this time I first saw the patient, and examination showed a copious, yellow, creamy, nonoffensive discharge escaping from an opening in the superior posterior quadrant. The lower part of the membrana tympani differed from normal very little. I was unable to withdraw any additional pus by the use of suction. The patient appeared ill and evidently felt so, largely from loss of sleep, continuous pain and septic absorption. There was no discoverable pathology over the mastoid process, the pain being confined to the temporal region, without external swelling or other characteristic signs. Hearing tests revealed audition almost nil through aerial conduction.

Blood examination gave a leucocytosis of 8,400, hemoglobin 70, and otherwise differed very little from normal. The X-ray showed a general haziness of the mastoid region, with almost complete destruction of the intercellular space. Lateral sinus normally located.

A simple mastoid operation was performed six days after the patient first consulted me. The cortex was sclerotic and considerably thickened. The antrum contained free pus and some granulation tissue. The lower half, especially involving the tip, bled freely, resembling the hemorrhagic type of mastoiditis. There was a small carious erosion exposing the dura through the tegmen antri, which no doubt accounted for the temporal headache. The patient made a rapid and uninterrupted recovery. The membrana tympani has regenerated, although it is still somewhat thickened and all the landmarks are not yet perceptible. The hearing has very largely returned.

The indications for a mastoidectomy were the generally unsatisfactory condition of the patient, the temporal pain, the abundant creamy discharge, the location of the perforation, and last but not least, the necessity for multiple myringotomy, and this, notwithstanding the fact that his temperature never

reached more than 99° and the laboratory reports, including the blood picture, varied but little from the normal. The prevailing organism was the streptococcus mucosus capsulatus.

Case 4.—W. P., male, aged 24 years. First noted pain in the left ear August 11, 1926. Examination the next day showed the left external auditory canal to be markedly swollen in the cartilaginous portion. A portion of the ear drum was visible, with no sign of middle ear inflammation. A diagnosis of multiple furunculosis was made and three abscesses, one on the superior aspect of the canal, another on the posterior wall and a third on the anterior wall near the floor, were incised under gas anesthesia, and the patient experienced considerable relief. On the fifth day following incision of the furuncles, he complained of pain in the region of the middle ear. Slight swelling was noted immediately behind the auricle. The canal wall remained so swollen that it was difficult to see any portion of the drumhead. The following night pain deep in the ear was severe. The next day, one week after opening the furuncles, a myringotomy was done under local anesthesia, but failed to disclose any pus in the middle ear cavity. Two days later, August 20th, patient was admitted to the hospital and the pain relieved by hot irrigations and the internal administration of allonal. Leucocytosis was 18,400; urinalysis negative. Two days later pus escaped from the middle ear. The canal remained greatly swollen and there was tenderness on pressure over the mastoid antrum and tip.

An X-ray examination showed the left mastoid evenly clouded. Partitions well preserved and no evidence of destruction; area reaching well back to occiput, mastoid unusually large. Leucocytosis at this time 12,600.

A week later conditions remained practically unchanged, except that there was slightly more tenderness on pressure over the mastoid and the canal wall was more swollen. A second X-ray at this time showed much more exudate in the area than the first one had done. Actual cellular destruction was apparent. The lateral sinus, crossing over the middle of large area, was not now distinguishable because of increased cell density. Sinus was not particularly superficial.

▲ culture taken from pus within the canal showed non-hemolytic streptococcus and staphylococcus albus.

A simple mastoid operation was performed August 30th, nineteen days after the onset of the furunculosis. No perforation of the cortex was found. On its removal an enormous mastoid cavity was exposed. The cortex was extremely hard and bled freely in its deeper portion. The entire mastoid was hemorrhagic in type and there was free pus in the antrum, the tip and in some of the zygomatic cells. The necrosis was extensive.

This case is interesting from the fact that it definitely started from a furunculosis of the external auditory canal, the middle ear and mastoid symptoms subsequently developing.

XL.

SUDDEN EDEMA OF THE LARYNX, ESPECIALLY
AFTER CHILDBIRTH.*

BY WOLFF FREUDENTHAL, M. D.,

NEW YORK.

It is not my intention in this article to speak of generalized edema in connection with a similar affection of the larynx, but rather of that class of rare cases in which the edema is localized exclusively in the larynx, with no visible signs in other parts of the body. These cases are, as a rule, unpleasant to handle, unless energetic action can be taken in many of them immediately.

There are many different forms of edema and the processes encountered are complex. We shall consider some of them here.

Edema of the larynx, or, as it is often called, edema of the glottis, is sometimes the result of typhoid fever. The writer has seen it only in connection with chondritis or perichondritis of the arytenoids. But cases are reported in which no affection of the arytenoids could be seen. Quite frequently edema is brought about by cardiac and nephritic lesions. Without previous local manifestations the larynx may become—and this is important—the seat of dropsical effusion in diseases characterized, in their advanced stages, by dropsy, such as Bright's disease, cirrhosis of the liver and phthisis, as pointed out long ago by Sajous.

Another type is angioneurotic edema, which comes and goes, just as other hysterical conditions, especially in women.

Several authors report cases in which edema occurred following some kind of traumatism, or even as a result of the introduction of a foreign body, or a scald due to inhaling steam, etc.

*Read before the Eastern Section of the American Laryngological, Rhinological and Otological Society, held at Brooklyn, N. Y., January 8, 1926.

In many instances various conditions are quoted in literature as exciting factors, but it is not always certain, as P. Heymann has pointed out, whether these were the actual causes or not. Thus, an edema may set in during a course of treatment of lues with potassium iodid, but we do not know whether the disease or the medicine was responsible. While we know that potassium iodid alone may produce it, it is not easy to account for all such cases.

Much more difficult, however, are the acute cases of laryngeal edema, or, as it is often called, the acute or essential or idiopathic edema, with a sudden onset of edema. Such is the case often, when the system is in a weakened state. Thus the peculiar conditions of malnutrition during the war gave rise to a number of cases, according to reports in European medical journals. These cases were studied thoroughly by His of Berlin and his pupils. The intermittent course was especially characteristic. These so-called cases of war edema improved after fats were added to the diet.

Undernutrition apparently plays a prominent rôle in the development of the edema. The results of such disturbances in nutrition are manifested in marked anemia, or disturbances of the endocrines, or disturbances of the circulatory system, as mentioned above.

As cases of influenza are being reported already in this season in our vicinity, it may be of interest to mention here the influenzal laryngitis, which though not identical with the cases under discussion, greatly resembles them. There are present a sensation of burning in the pharyngeal cavity and stinging pains in the throat on deglutition combined with an actual feeling of suffocation. The larynx is sometimes very sensitive to the touch and phonation is painful. Laryngoscopically we see a pronounced edematous infiltration of the posterior region of the larynx, as observed frequently by Moure of Bordeaux. The mucous membrane covering the arytenoids is not only red but infiltrated, and projects at the orifice of the esophagus. In other cases, serous infiltration of the aryepiglottic folds was observed with slight or pronounced swelling posteriorly.

The appearance of the larynx in typical cases of edematous laryngitis is very characteristic, and cannot be mistaken for

anything else. The great vascularity of the larynx, together with the fact that the blood vessels of the mucous membrane are practically unsupported, permits rapid congestion, and there is a leakage into the perivascular tissue. The exuded serum fills the intercellular spaces and lymph channels, and a certain amount is taken up by the connective tissue or by the epithelium. This infiltration, if not promptly relieved, may in turn give rise to hydropic degeneration (Braden Kyle). The infiltrated areas often present the appearance of a globular, semitransparent mass, "very bright in tint at the circumference." The mucous membranes are ordinarily very pale, the vocal cords irregular and the ventricular bands also infiltrated. The edema of the arytenoids, either of one or both, is sometimes so outspoken that this in itself may cause a severe dyspnea. An excellent illustration of this may be seen in Moure's handbook. In other cases the edema of the cords alone is sufficient to produce this symptom.

The larynx never gives the appearance of being the seat of a purulent or even of a seropurulent infiltration.

At any time during the course of a disease the edema may become so severe as to cause death, unless tracheotomy can be done at once. This was noted in one of my cases. Lately, Dr. Herwart Fischer of Breslau has demonstrated twenty original specimens, collected by himself while physician to the courts. In all of his twenty cases sudden death occurred, due to edema of the glottis. Fischer discusses the medicolegal aspect of such cases, where death ensues suddenly in previously healthy people or in persons who had been sick only a brief time. Thus, a suspicion of death from unnatural causes may be aroused, as poisoning or a trauma inflicted by another person. The opinion of an experienced laryngologist may be of great value in such cases. But one should remember that edema of the larynx does occur not only *intra vitam*, but as a postmortem condition, as, for example, in drowned persons, or not infrequently in the newly born.

In all articles on this subject that I could find in the literature one class of cases has not been mentioned, and that is those with a sudden onset of laryngeal edema occurring in women immediately or shortly after delivery. Three such

cases were seen by the writer and will be reported below. Whether they were due to a disturbance of nutrition during pregnancy or to the strain of delivery or to something else cannot be stated with absolute certainty. It is plausible, however, that pregnancy, in certain instances, may give rise to a state of undernutrition.

My first case was observed more than twenty-five years ago, when I was called in the middle of the night to a woman who suffered severely from dyspnea. The accoucheur told me that the patient, a multipara, had given birth to a child after normal labor but a few hours previously. Almost immediately afterwards difficulty in respiration set in. This was constantly growing worse, so that three hours after confinement I found her suffering so intensely from dyspnea that her lips were cyanotic and she was struggling for breath. Immediate intervention was obviously indicated. Never having come across such a case, I made a hasty examination to detect, if possible, the presence of a foreign body in the larynx. The facilities in that small apartment were such that it was impossible to get a clear view of the larynx. A tentative diagnosis of laryngeal edema was made and tracheotomy done as quickly as possible. After its performance the patient began to breathe normally.

As a foreign body was never found, and later examinations confirmed the tentative diagnosis, it may be asked, What was the cause of this severe edema? The kidneys, heart, liver, etc., were examined, but with completely negative result. The only explanation that seemed plausible to me was that by the act of straining or crying, or both combined, a small traumatism in the larynx may have taken place, after which edema developed. Besides, the patient appeared very much undernourished.

The second case was a woman, 34 years of age, who came to my office two weeks after the birth of her fourth child. She, too, became slightly dyspneic two hours after her last confinement. A laryngoscopic examination, which could be made easily in this case, revealed an edematous laryngitis. Nothing was found that could be held responsible for the sudden onset of the edema. Although the arytenoids were involved in the process, she recovered slowly, but about a year later developed an acute phthisis, of which she died. I would like to re-

peat that no involvement of the lungs was found so long as she was under my treatment.

The most important and exciting incidence of edema of the larynx was my third case.

One morning a physician called me up and asked whether I would see a laryngeal case requiring immediate attention. I answered in the affirmative. Soon afterwards, while working at my rear office, I heard the heavy, stertorous breathing so typical of a stenosis of the larynx or trachea, announcing the arrival of the patient. She informed me that three weeks previously she was confined of her fifth child. Everything went easy. The child is living and doing well, being nursed by the mother. Six to eight hours after delivery she noticed some difficulty in breathing, which gradually grew so intense that she summoned her physician. The patient looked very pale and anemic, had lost considerable in flesh, but no tangible cause could be detected for the dyspnea except her pregnancy. On examination again, an outspoken edematous laryngitis was found. The arytenoids did not appear enlarged or otherwise affected by the process, but it was the very marked edema of the ventricular bands that caused a stenosis and severe dyspnea. The swelling of the bands was irregular, in some parts appearing globular.

I immediately got in touch with her physician and advised tracheotomy at the earliest possible moment, in order to avoid further trouble. The patient, however, objected to an operation and begged me to relieve her by other means. Well, much against my inclination as well as contrary to all indications, I was forced to give her a prescription, at the same time advising her physician to watch her carefully and be ready at any moment to do tracheotomy or have it done by someone in his vicinity. A week later the woman returned, and again I could hear her loud, heavy breathing as soon as she entered the waiting room. When I asked her how she felt, she answered: "Much better. Your medicine helped me wonderfully." This sentence was constantly being interrupted by heavy, stertorous breathing. A week later she again consulted me, but again rejected my advice as to a tracheotomy. Four days later her physician called me up on account of urgent dyspnea, as the patient wanted some remedy to relieve her. The stridor was

fierce, I was told. My advice to use adrenalin instillations by means of a laryngeal syringe, eventually to be followed by inhalation of some mild oil, afforded so much relief that the patient was able to sleep. She visited me at intervals of a week or more, always with the same grave symptoms and always telling me how much better she was feeling. Finally one night her physician phoned requesting me to come at once and do a tracheotomy. She had marked cyanosis and was apparently in extremis. Before I could get dressed another phone message informed me that she had passed away.

There is no doubt in my mind that this woman's life could have been saved by a tracheotomy, but unfortunately this could not be done on account of her fear of an operation. This conviction is based on the fact that she was examined by several internists while under my care. Never could they find anything to account for her edema, so that the disease was strictly limited to the larynx. She had become habituated to this so greatly restricted supply of air to such a degree that she became alarmed only when she was almost in extremis, and that happened several times.

I would add that there was no external pressure on the larynx, as by a tumor, in this case.

The question of an intubation was never mentioned, for the reason that it could not have been accomplished in any of my cases. The lumen of the glottis in all of them was so small that no tube could ever pass.

Essential or idiopathic edema of the larynx with a sudden onset is not very rare in young children and infants. Many such cases have been studied, and the diet (excess of carbohydrates, salt, fats, etc.) have been held responsible for this condition. But in my three patients nothing of the kind was present. Special diet and special care were of no benefit in the last of my cases reported here, so that the only thing that could be considered as causative was the confinement, with or without a traumatism occurring during the delivery.

24 W. EIGHTY-EIGHTH ST.

XLI.

RECENT LITERATURE ON CRANIAL RESONANCE AND ITS CLINICAL APPLICATION.*

BY ROBERT SONNENSCHN, M. D.,

CHICAGO.

This talk is not intended as a serious paper, but, as the title indicates, merely a short review of recent literature of the past two or three years on the subject of cranial resonance and its clinical application. The study of bone conduction is a very important one, as we have indicated in previous articles, and we feel that it offers the key to the diagnosis and, therefore, to the prognosis of many ear conditions.

H. G. Runge (*Ztschr. f. Hals, etc.*, Vol. 5, 289, 1923) described his "water filling" test, in which a cubic centimeter of water was instilled in the ear, the bone conduction then tested and compared with previous findings. He found in normal instances that the bone conduction is about twice as long with water in the ear as it is without it. He admits that similar experiments were done by Wheatstone as early as 1827, and later by Politzer, Lucae and others.

In cases of otosclerosis there was no lengthening of bone conduction. Likewise, there was no prolongation of bone conduction after a radical mastoid operation, but in diseases of the auditory nerve, bone conduction was usually increased.

Runge believes that the increased bone conduction, normally present when the ear is filled with water, is due to two things, namely:

1. A better transmission of sound to the drum membrane by the fluid;

2. To a diminished "outflow," or escape of sound from the ear, the former being probably the more important factor.

It appears to me that the principles involved in the Runge test are similar to those when the finger is placed in the ex-

*Read before the Chicago Laryngological and Otological Society, December 6, 1926.

ternal canal, as in the so-called Bing test, to see whether increased bone conduction is produced. If you already have prolonged bone conduction there will be no increase, but in normal cases it will be lengthened.

Attention has lately been directed by various writers to the fact that we have to differentiate between "resonance" of the various cavities of the skull (depending on the natural frequency of the parts of the cranium), and the phenomenon which we call "bone conduction." A resonator responds to any source of sound which has the same natural frequency as its own, whereas the bone itself responds to forced vibrations if the mass has not the same frequency as the vibrating mechanism, such as a tuning fork. The degree of conduction depends upon various factors, such as the thickness of the skull, presence and size of air spaces, adhesions of the dura, age of the individual, etc.

Demetriades (*Zeitschr. f. Hals, etc.*, Vol. 9, p. 296, 1924) has done considerable work on resonance and bone conduction, including experiments on animals and on human beings in whom the unilateral resection of the sympathetic nerve was performed. His conclusions regarding relation of the vasomotors to head resonance and bone conduction are:

1. Dilation of blood vessels, due to paralysis of the vasomotors, produces an increase of the head resonance on the side of the paralysis.
2. Stimulation of the vasoconstrictors causes diminution of the head resonance on the side of stimulation.
3. As a result of the failure of reflex contraction of the blood vessels which causes vasomotor paralysis, the resonance is increased because of passive congestion of the deeper lying structures.
4. The middle ear and external auditory canal influence head resonance, but it is possible that too much significance is attached to hyperemia (due either to dilation of the blood vessels or to active inflammation).
5. Auscultation through the skull, and by way of the external auditory canal, does not always give the same value.
6. So far as one can transfer conclusions derived from animal experimentation to man, it may be said that the relation

of bone to air conduction (Rinne test) is partly dependent on head resonance.

7. The vasomotors and the condition of the blood vessels play important parts in the increase as well as in the diminution of head resonance and bone conduction.

8. By means of the change in the resonance, it is possible to understand certain cases of injury to the acoustic nerve with increased bone conduction and a negative or positive Rinne. This may also be done with some malignant tumors and with congenital syphilis.

Demetriades is of the opinion that the question of cranial resonance and its examination should be left to the otologist rather than to the neurologist. He uses in this examination an apparatus (*kranioacoustikon*) which is very similar to that designed by Kless in 1908, which he attaches to the head of the patient. It is so arranged that the fork can be held steadily in one place, and then the ears of the patient are connected with those of the examiner by means of tubing. The tuning fork should be struck forcefully, always at right angles to the skull, and kept in one definite position, either upon the head or upon the band of the apparatus. The author also calls attention to the fact (as emphasized by Claus and others) of the contralateral perception of sound by cranial resonance when the fork is placed on either side of the head, lateral to the median line. After investigation of the resonance in 27 cases (*Monatschrift f. Ohrenheil.*, Vol. 60, September, 1926), in which there were labyrinthine findings, the author comes to the following conclusions:

1. Individuals with normal ears usually show greater cranial resonance to the right than to the left side.
2. Where there is a loss of function of one labyrinth, there is a diminished resonance on that side, as compared with the opposite normal side. This was also found in cases of disease of the labyrinth where there was a difference in irritability of one side as compared with the other.
3. "Finding of better resonance on the one side where the labyrinth is more responsive to stimulation is not accidental but has a definite etiologic basis."
4. The finding of "better resonance on the side of the more irritable labyrinth" may be absent in cases of fractures or

tumors of the base of the skull, vasomotor disturbances, cerebral tumors, arteriosclerosis and syphilis. In such cases we are dealing with conditions which have extended beyond the labyrinth.

5. Examination of the cranial resonance is valuable not only in neurology as well as in otology, but to be of definite use the whole picture of the ear and nose findings must be included.

Schoen and Goldberger, in the *Monatschrift für Ohrenheilkunde*, Vol. 59, p. 19, January, 1925, called attention to the fact that most of the tuning fork tests depend to a large extent upon the subjective statement of patients, and that it would be very desirable to have some objective measure. They described their procedure in testing head resonance by means of a double phonendoscope, which connects the examiner's ears with those of the patient, via external auditory canals.

The examination of bone conduction is divided into three different parts:

First—in which the function of skull as a resonator;

Second—in which the perceptive ability of the organ of hearing, and

Third—in which the actual conduction of sound through bone is considered.

The method consists principally of two parts:

1. The tuning fork is placed on the head of the patient in the median line of the vertex, on the forehead, on the root of the nose, on the external occipital protuberance, or in the region of one of the nasal accessory sinuses (the frontal, ethmoidal or maxillary).

2. For control of the acuity of the patient's perception, the tuning fork is placed on the head of the examiner. The patient's ears (as before stated) are connected with those of the examiner, and he is instructed to tell what he perceives with reference to the conduction of the sound.

The authors believe that by this method they demonstrate that the skull acts as a resonating chamber, which responds especially to the deeper tones, and that by means of the phonendoscope this resonance can be tested objectively. They are also of the opinion that they are thus able to make the diag-

nosis in various ear conditions without the aid of the usual tests such as the Weber, Schwabach and Rinne.

It seems to me that the points brought out by the authors are very interesting, but some of them are not really new. By a simple experiment Bezold showed long ago that air conduction is usually longer than bone conduction, in that when a tuning fork is placed on the head of the individual "A," and he no longer hears the sound, individual "B," whose ear is connected by a nonaural stethoscope with "A's" head, can still hear the tuning fork for about ten seconds. Schoen and Goldberger have come to the same conclusion; they say it is a very important and interesting phenomenon that the tuning fork vibrating on the head of the patient is heard as long, or even longer, by the examiner, who is, of course, hearing it by air conduction. Bezold also emphasized that the craniotympanic conduction is better by far than the direct craniolabyrinthine route.

There is in the March, 1926, number of the Archives of Otolaryngology, a paper by Cohen and Nussbaum, called "A New Method for Testing Hearing." Based upon tests of Schoen and Goldberger, in their summary they state:

1. This method is much more rapid than the older method, and

2. It controls the subjective statements of the patient with the objective findings of the examiner, thus checking up on the answers given by the patient, and permitting us to locate abnormalities very quickly.

3. Improvement, if present, can be definitely and rapidly noted from time to time.

4. This method can be performed by a nurse or secretary.

5. It places the hearing tests on a numerative basis, so that the patient or his physician can be told the exact amount of his hearing in a percentage formula.

6. One knows the specific value of every point of contact between fork and bone in reference to resonance, and one always uses the same spot during the entire procedure, thus avoiding the faulty conclusions of the ordinary way of testing.

7. It does away with the impossible task of always striking forks with the same force. Since the same fork is used it is

found that the time required for the complete fading of the vibrations is always the same, no matter how it is struck.

With all due respect to the authors, it seems to me that it is better policy not to have this test performed by a nurse or a secretary, but to let some medical man do whatever testing is to be done. In the first place, a physician is more likely to evaluate results as compared with the clinical findings, and secondly, it makes a rather poor impression on the patient in that he may feel that the test is of not much importance when the physician himself does not undertake it. Perhaps these are more academic than practical objections, but I offer them for what they are worth. So far as being able to give a definite percentage of hearing loss, it seems to me that only a method such as that employed with the audiometer, or the use of forks supplied with the constant of damping or decrement, can give a percentage of loss of hearing figured in sensation units.

George Claus (*Monatschrift für Ohrenheilkunde*, etc., Vol. 60, April, 1926) presents a detailed article on cranial bone conduction and crossed perception. He calls attention to the fact that there are many fallacies in the determination of the length of bone conduction; the way in which a tuning fork is held, the firmness of contact between the upper and lower maxillæ, the lateralization of the sound by changes in the position of the angle of the mouth—all these may very materially influence the duration of bone conduction. Depending on various factors, differences of from 8 to 20 or even 25 seconds may be noted.

He calls attention to the fact that a great many men previously studied bone conduction and skull resonance, among these being Lucae, Troltsch, Kessel, Urbantschitsch, Frey, Eitelberger, etc.

It was known for a long time that with the tuning fork placed on the median line of the head in normal individuals the tone is not lateralized, in other words, the Weber "is in the head." Even if the fork is placed on the median line of the skull, individuals with normal ears may not hear it in the whole head, or equally well in both ears, but it is at times, for no well known reason, lateralized to one or the other side. This is, of course, an observation that many have made with reference to the ordinarily performed Weber test. Even if

an objective control be instituted by means of the phonendoscope, connecting the ears of the patient and the examiner, it is not always reliable, since the patient may cause a difference in the lateralization of the sound by changes in the position of the angle of the mouth, the closing together of the jaws, etc., as previously noted. However, when the fork rests external to the median line of the skull, the sound is usually heard louder on the opposite side, giving what has been termed "diagonal resistance."

The skull is divided into two equal portions when the fork is placed on the median line, but if the stem rests lateral to the median line it divides the skull into two unequal portions, the smaller being that adjacent to the fork, the larger being the one on the opposite side of the head.

If, as emphasized by Schoen and Goldberger, this is always so, then with marked defects of the skull the Weber should be lateralized, but, according to Freml, it is not. Claus claims that the term "crossed perception" is a happier one, since it describes the facts which occur and does not attempt to explain the origin of the phenomenon. He criticises Goldberger and Schoen's method of testing the nasal accessory sinuses by way of cranial perception or resonance, with special reference to the ethmoid, because if the stem of the fork is moved slightly toward or away from the median line, a matter of a few millimeters, in the region of the lacrimal bone, the lateralization varies from side to side.

Clause used in his work an unweighted c-1 (256 double vibrations) fork and placed it upon the vortex instead of upon the mastoid process, allowing it to rest against the skull of its own weight, for when placed upon the mastoid process it is very difficult to hold it in position without exerting considerable pressure. He does not place it upon the mastoid process in order to avoid the so-called "diagonal resonance" of Schoen and Goldberger.

CLINICAL APPLICATION OF "CRANIAL RESONANCE," ETC.

Anything that will help make our tests more objective will certainly be welcomed. Thus far we have always depended upon the subjective statement of the patient when making functional hearing tests. Lack of attention of the individual, a

low degree of intelligence, attempt at malingering, all influence the findings of a test. It is quite true, when using the double phonendoscope suggested by Schoen and Goldberger, the operator is able, with his own ears, to verify diagonal or crossed resonance of the skull.

A number of points must be considered, however, which may indicate a few fallacies, at least so they have seemed to me in the rather limited number of observations we have been able to make. We do not wish in any way to be considered as discrediting the resonance tests, but we feel that before we can accept them at their full value, difficulties of interpretation which we have met should be solved to everyone's satisfaction. Some of the facts to which our attention has been called in the making of the tests are the following:

1. In the first place, it is most essential that the examiner's ears be normal or that he know very definitely his own defect.

2. Even normal individuals may have considerable difficulty in noting a lateralization of sound to one or another part of the head. This fact, brought out long ago with reference to the Weber test, well known to otologists, emphasizes that it is very difficult for many individuals to realize that a sound has been lateralized, and if so, to which side. Many individuals with the Weber test show a lateralization from the median line of the skull, even though both ears are apparently functioning normally, and conversely, an individual who has a lesion in one ear may refer the sound to the middle of the head or to the opposite ear. For these variations no definite explanation has ever been offered of which we are aware.

3. In the third place, depending on the point at which the fork is placed in testing the sinuses, especially in reference to the ethmoids, markedly varying results are noted, with a difference of only a few millimeters in the point at which the fork rests, and, therefore, the findings must be noted with great caution, since the lateralization is so easily influenced.

4. When there are bilateral lesions of the ears we have observed that the results are very confusing to the examiner. If one ear or the other shows a combination of inner and middle ear involvement, the question of diagonal resonance is at times very indefinite or contradictory, and the findings

very difficult of interpretation, at least with our limited experience.

5. We should recall the fact that vibrations may traverse the cranium without being at all perceived, as was stated by Bezold long ago.

6. We found that variations in the intensity of striking the forks sometimes gave changes in lateralization.

We should remember that while much credit must be given to the older otologists who have already done somewhat similar tests, we must also be grateful to men like Schoen, Goldberger, Claus, Demetriades and others who have again emphasized and modified them. It often happens that good work is forgotten, and it is to the credit of men who revive and investigate old problems. It will, of course, require many tests by many observers before it is possible to come to a definite conclusion regarding the ultimate value of the newer methods of testing cranial resonance. As for myself, I intend to make these tests consistently for some time in order to come to a definite decision regarding them. It seems to me, however, that the older fundamental tests, when properly performed and combined with a complete clinical examination, will give us sufficient data for diagnosis of the state of hearing; but if experience proves that the newer tests furnish additional information, we should utilize them to the fullest possible extent.

29 EAST MADISON ST.

XLII.

THE USE OF FOREIGN BODIES IN EAR, NOSE AND THROAT SURGERY.

BY HARRY L. POLLOCK, M. D.,

CHICAGO.

Inasmuch as I am to discuss one of the phases of plastic surgery, I deem it of sufficient interest to my audience to give a very brief history of this subject, from the time of Celsus down to the present century. In reviewing the recent literature on plastics, one is astonished at the large number of authors who have devoted entire papers to the history of this subject alone. In 1909, Otto Hildebrand¹ published a monograph entitled "Die Entwicklung der plastische Chirurgie," and the following statements are quoted largely from his paper.

Celsus was the first and only one of the ancients to mention plastic surgery. He wrote entirely on plastics of the nose, lips and ears and did not go into general surgery. None of the other noted Greek, Roman or Arabian physicians seemed to know anything of this subject, for nowhere is mention made of this topic. So far as Europe is concerned, this subject lay dormant until the fifteenth century, when two Sicilians, Branca or Brancas, father and son, revived plastic surgery. They did a great deal of work secretly. It is known, however, that the father used flaps from regional parts, while Branca, Jr., who did the major portion of this work, obtained the flaps from the arms of his patients. This latter procedure has since been known as the "Italian method" and is still used extensively by modern surgeons. They were followed by two Calibreans, Bojani brothers, who also used the arm flaps. During the next two centuries nothing was published concerning the work, although it is known that plastic surgery was performed extensively in Southern Italy. Late in the fifteenth century Taglizcozzi, professor of anatomy and medicine in Bologna, published a lengthy treatise on plastic surgery, which gave real inspiration to contemporary surgeons, and he is now consid-

ered the real founder of plastic surgery. Drawing nearer our own time, Graefe was the first of our modern surgeons to devote his time and energy to plastic work, and he highly recommended the Italian method, while Diffenbach, by his life's work and interest, gave the greatest impetus to modern plastics. We find that plastic surgery was being performed for many centuries in India, although it was unrecorded in medical literature. It is known that they employed regional flaps. Hence this procedure is known in our time as the "Indian method." It is of interest to know that India anteceded other countries in the use of plastics because one of its commonest forms of punishment, for even trivial offenses, was the slashing off of the culprit's nose. The criminals, anxious to assume their places in society, sought medical aid in the restoration of their features, making facial plastics a necessity. Judging from this short history, we are led to believe that very little was published concerning plastic surgery before the middle of the past century. Yet Edward Zeis,² in his book on plastic surgery, published in 1863, recorded and abstracted two thousand and eight articles written prior to that time, proving that the modern medico is not unique in presenting prolific records of the work he is doing.

Arriving now at my portion of this symposium, namely, "The Use of Foreign Bodies in Ear, Nose and Throat Surgery," I find in the literature mention of many types of foreign material, such as gold, silver, vulcanite, plaster of paris, sealing wax and decalcified bone, and in practically every case their use was practically confined to cranioplasty, with but little mention of their employment in plastic surgery about the face. Until the present century, all plastic surgery about the face had been done exclusively with the aid of skin flaps and without the support of any underlying framework. Since then three types of foreign materials have been extensively used by modern surgeons, namely, paraffin, celluloid and ivory, which I shall discuss in this paper.

Vaselin and Paraffin.—R. Gersuny,³ in *Die Zeitschrift für Ohrenheilkunde*, in 1900, published a paper entitled "A New Subcutaneous Prothesis," describing the use of vaselin. He tells of a patient whose testicle he was obliged to remove because

of tuberculosis. Returning to him a year later, seeking the Doctor's help in avoiding ridicule to which his call to army service would subject him, Gersuny injected vaselin into the scrotum with a perfect cosmetic result. Later, he used vaselin in cases of cleft palate by injecting it into the uvula and posterior pharyngeal wall. In cases of saddle nose, he used it successfully and highly recommended this method. Following Gersuny's article, paraffin was substituted for vaselin and was employed very extensively until the evil after effects became known, when it was discontinued by all ethical surgeons. We have all seen some of the bad results from its use, and I hereby quote from a résumé of its dangers, as cited by Dr. Joseph C. Beck,⁴ in his contribution on plastic surgery to Loeb's "Operative Surgery of the Nose, Throat and Ear":

1. Toxic absorption.
2. Marked inflammatory reaction.
3. Loss of tissue due to infection and abscess formation.
4. Pressure necrosis caused by hyperinjection.
5. Sloughing of tissue as a result of the heat of the material injected.
6. Sloughing due to injections into very dense or inelastic structures or where scar tissue is firmly attached to underlying and adjacent parts.
7. Subinjection or too small an amount of paraffin with an insufficient correction of the deformity.
8. Hyperinjection with overcorrection of the deformity.
9. Air embolism.
10. Paraffin embolism.
11. Primary diffusion or extension of paraffin when first introduced into adjacent nasal structures.
12. Interference with muscular action of nose.
13. Escape of paraffin after withdrawal of needle.
14. Solidification of paraffin in the needle.
15. Absorption or disintegration of the paraffin.
16. Difficulty in procuring paraffin at proper melting point.
17. Hypersensitiveness of skin over injected area.
18. Redness of skin over the injected area.
19. Secondary diffusion of the injected mass.
20. Hyperplasia of the connective tissue following the organization of the injected matter.

21. A yellow appearance and thick lining of the skin after organization of the injected matter.

22. Breaking down of the tissue and a resulting abscess, due to pressure of the injected mass upon the adjacent tissues after the injection has become organized."

There is no question that all these difficulties and dangers are authentic, and every one may occur in the practice of a plastic surgeon where paraffin is used to a great degree. Another danger not specifically enumerated is the formation of a paraffinoma, which we class as malignant, but not in the sense of a carcinoma or sarcoma. There is a gradual infiltration of connective tissue into adjacent structures, as, for instance, when injected subcutaneously for a depressed saddle nose, the paraffinoma attacks the orbital cavity and may cause serious injury to these structures. As examples, I cite two cases. The first, Miss N., a young lady, twenty years old, consulted an ethical rhinologist regarding the appearance of her nose. She was advised to refrain from any interference, as the nose was perfect. Notwithstanding, she consulted an advertising charlatan, who immediately injected paraffin subcutaneously. For a short time she was apparently pleased with the result, but within a year there was noticeable a reddening and irregular surface at the site of injection. This irregular red mass gradually spread over the forehead into her cheeks and into the orbital cavity, accompanied by severe pains over the entire region. With this picture, she came to us for relief, both for pain as well as for cosmetic reasons. The overlying skin was infiltrated and so firmly connected with the paraffin that it became necessary to remove it with the tumor. Large masses of paraffin were removed from the whole region, with the result that while the pain was relieved, the appearance of the area was unsightly and depressing. Subsequently, a flap from the arm was obtained which covered the defect, but it was white and has ever remained so, while the adjacent skin is red. Two attempts to elevate the depressed graft, one by implantation of bone, the other of ivory, resulted in failure, as the tension was too great due to the fact that we were dealing with too much scar tissue. The other case is one of multiple growths due to injections of paraffin in various parts of the face and neck. This lady, a graduate nurse, not

liking the wrinkles in her face and neck, decided to do her own injecting, the result of which I shall show later in a lantern slide.

Years ago my associate, Dr. J. C. Beck,⁵ following the recommendation of von Stein, a Russian rhinologist, injected paraffin into the inferior turbinate bodies in cases of atrophic rhinitis. He reported his results in the *ANNALS OF OTOTOLOGY* in 1907. In the seven injected cases he temporarily obtained good results, but in a very short time the paraffin sloughed out, leaving the condition of the nose the same as prior to the injection. Some time later we conceived the idea that if we could place the paraffin under the skin or mucous membrane without injecting it, most of the dangers could be averted. I reported a series of cases in which I obtained excellent results in atrophic rhinitis by using paraffin inlays under the mucoperichondrium of the septum. While we had no complications from this procedure, the end results were unfavorable, as nearly all of these inlays eventually sloughed out.

Celluloid, the second of these heterogeneous substances, has not been extensively used. Oscar Förderl,⁶ in the *Wiener medicinische Wochenschrift*, in 1903, was the first to suggest the use of this substance in plastic surgery, and he recommended it only to cover cranial defects. H. Koshier,⁷ in the *Wiener medicinische Wochenschrift*, in 1908, advised its use in plastic surgery about the face. He used it as a framework in reconstructing a new nose. He shaped his celluloid first and then buried it under the skin of the forehead, and after it had become attached he made his flap from the forehead, including the celluloid inlay, and turned it down to construct the nose. He reported two cases, one in which the celluloid sloughed out, and the other in which the celluloid remained in place until the patient died, one and one-half years later, from an intercurrent disease. In the *Journal of the American Medical Association* of April 16, 1918, Dr. Gordon New⁸ reported his experience with this material. He had the celluloid perforated, trusting that the connective tissue would grow through these openings and hold them in place. In four of the six dogs on which he experimented, the inlays sloughed out, while in the other two they remained in situ. When removed, it was found that the connective tissue had grown through the perforations.

He then tried it in five cases of saddle nose with good results. Desirous of knowing the ultimate results of these implants and finding no reference to same, I wrote to Dr. New and was informed that he had discontinued the use of celluloid in plastic surgery, as all of those reported cases had sloughed out within a period of three years. In reviewing the literature, I found no further reports on celluloid, so that we must conclude that it has been an utter failure in plastic surgery.

Ivory, the third substance, has been used by European surgeons for a number of years, but it is only recently that it has been used in America as framework in plastic surgery about the face. Jacques Joseph,⁹ in *Deutsche med. Wochenschrift*, in 1919, states that inasmuch as bone transplants often become absorbed, he has substituted ivory implants in the treatment of saddle noses, but at this time he is not prepared to give any data. He has been using them almost exclusively ever since (1919), and Maliniak,¹⁰ in the *Archives of Otolaryngology*, 1925, states that while with Joseph for a year and a half, he had occasion to examine some of the earliest cases implanted and found that they were still in place. In fact, he states, he never saw a single case slough out.

Bone and cartilage have been employed almost universally, the bone being obtained from either the tibia or rib and the cartilage from the costal cartilage, the ear or occasionally from the nasal septum. From our personal experience, we consider ivory preferable to either bone or cartilage. Ivory as obtained from the tusks of elephants is similar in its construction to bone. If anyone is particularly interested in the chemical and microscopic examination of ivory, I refer you to Maliniak's paper, in which he gives an exhaustive study of the chemical and microscopic comparison of bone and ivory. He also draws attention to a "vegetable ivory," which is obtained from the kernel of the nuts of the *Laguna* palm tree (*Phytelephas macrocarpa*). He believes this vegetable ivory superior to the natural ivory, but with the former we have no experience and therefore cannot give a comparative study. We found ivory preferable to bone for the following reasons: (1) Ease of obtaining implant. If bone is employed, it must be obtained from the tibia or rib, causing the patient to undergo a double operation, one for the obtaining of the implant, and the sec-

ond, the plastic operation. When the implant is obtained from the tibia, there is, first, a risk of infection with long continued suppuration, and the danger of an osteomyelitis, and second, continued pain in the region of the wound, and third, spontaneous fractures. Cases of spontaneous fractures have been reported, even if only a small portion of the crest has been removed. If the implant is taken from the costal cartilage or rib, then there is risk of infection of the rib wound with a resultant osteomyelitis of the rib or sternum, or empyema with a prolonged convalescence. If the cartilage is obtained from the ear, there is a risk of infection, resulting in a chondritis or perichondritis, thereby causing a deformity of the ear. If the cartilage is taken from the septum and infection occurs, a septal abscess, with all its evil after effects, may follow. (2) Exact shaping of implant, (a) in shaping or bending implant if bone, there is the risk of breaking and spoiling its usefulness; (b) the difficulty in obtaining a piece of bone or cartilage of the desired size, as frequently the implant is too small and an additional piece is necessary. Our experience shows that a single implant gives better results than where numerous pieces are used.

When using ivory, we can measure the size that is needed with a great deal of accuracy, though should it prove too large at the time operation it may then and there be reduced to the desired size. We always have many pieces sterile and ready for use, and it is an easy matter to select the required one. The edges of the bone transplants are often rough and sharp, sometimes causing them to penetrate the overlying skin. This complication does not occur with the use of ivory, as its edges can be made as smooth and round as desired. (3) In sterilization, ivory, unlike bone or cartilage, can be boiled and put through the strongest disinfectants without affecting its usefulness. (4) Absorption of the implant. There is little or no chance of the ivory implants being absorbed, for now, more than seven years since these transplants have been used, there is no record of even the earliest cases disappearing. On the other hand, there has been and still is much discussion as to the absorbability of bone and cartilage. Most authorities agree that if bone with its periosteum or cartilage with its perichondrium be used as implants and brought into direct contact with

living bone, there is little danger of its being absorbed. In using these tissues for plastic work about the face it is necessary often to bury them in soft structures, and it is then that they are likely to become absorbed or degenerate into fibrous tissue. Again, it has been observed that occasionally they hypertrophy, especially the cartilage, thereby causing a deformity. We had such a condition in a physician who had had costal cartilage implanted for a saddle nose. Within two years there was a large lump, due to the hypertrophy of the cartilage, and a second operation was necessary for the reduction of the hump.

The disadvantages of ivory are twofold. First, it is a foreign material and does not grow or live like bone or cartilage and become an integral part of the body. It has been shown that it eventually becomes encapsulated by a firm fibrous capsule just as other foreign bodies, such as bullets, pieces of steel, etc., do. Owing to the fact that it does not become an integral part of the body, there is a greater likelihood of its becoming displaced, which condition we have occasionally observed. At present we are perforating the ivory implants, with the hope that the connective tissue will grow through the small openings, holding them firmly in proper position. Second, the danger of the implant sloughing out must be considered. It is now over three years since we have been using ivory implants almost exclusively, and thus far none has sloughed out except in those cases where primary infection occurred. As previously stated, reports coming to us from European clinics corroborate our finding, with the additional fact that they have observed these cases for a period of over eight years.

To describe all of the various plastic operations in which ivory is used is not within the province of this paper. Suffice to say that wherever and whenever bone or cartilage has been or can be used, ivory makes an excellent substitute with all the advantages I have enumerated. I shall present a number of slides demonstrating the ivory in situ in various plastic operations. I wish to call your attention particularly to the slides depicting ivory implants in case of atrophic rhinitis, demonstrating their adaptability in the treatment of this disease. Three years ago¹¹ I presented a paper before the Triological Society entitled "Intraseptal Implantation in Atrophic Rhin-

itis," in which I described my method of implanting bone and cartilage under the mucoperichondrium of the septum in the treatment of this condition. I reported excellent results by this treatment, but explained the difficulty in obtaining the implants. During the past year and a half,¹² I have been using ivory implants instead of bone, and in May, 1926, presented this method and its splendid results to the Chicago Laryngological and Otological Society.

CONCLUSIONS.

1. Foreign materials, such as gold, silver, vulcanite, plaster of paris, decalcified bone, paraffin and celluloid have been tried in plastic surgery about the head and have all been discarded by ethical surgeons.
2. Ivory, in our experience thus far, is an ideal material to use as a framework in plastic surgery and is superior to either bone or cartilage. It is, however, still too early to make definite assertions as to the permanency of results from the use of this material in plastic surgery, though we feel much encouraged by the reports of our German colleagues, which lead us to believe that we need not fear the absorption or loss of these implants.

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XLIII.

TRACHEOTOMY AND INTUBATION.*

BY HARRY L. BAUM, M. D.,

DENVER.

For some time I have been impressed by the fact that many men, both laryngologists and others, do not seem to have what to me appears to be a proper conception of the relative importance and relationship of the two procedures which are the subject of this paper. For this reason it may be permissible to review certain of the indications for these procedures and to discuss the advantages and disadvantages of each from an entirely practical viewpoint, limiting the discussion to their use for the relief of laryngeal obstruction only. The question of technic will be omitted, with the exception of certain points which seem to have a direct bearing upon the matter under discussion.

The observations in this paper are based upon my own personal experience with tracheotomy and intubation in the following types of cases: Acute inflammatory, including those complicating influenza, pneumonia, laryngotracheobronchitis and in acute laryngitis; diphtheria, measles, local trauma from instrumentation and foreign body; true edema from constitutional causes and from retropharyngeal abscess; cervical abscess; inflammatory stenosis from the presence of irritating organic substances in the tracheobronchial tree; papilloma, cicatricial stenosis, tuberculosis, syphilis and malignancy; fracture, typhoid chondritis, gangrene of epiglottis in a case of cardiorenal disease and one or two cases of perichondritis with stenosis in which an etiologic diagnosis was not made. In addition, free use has been made of Chevalier Jackson's book on "Peroral Endoscopy and Laryngeal Surgery" and of various articles in the literature, too numerous to mention.

Although tracheotomy is a much older operation than intubation, the latter, as a result of O'Dwyer's epoch making con-

*Read before the Colorado Congress of Ophthalmology and Otolaryngology, July 16, 1926.

tribution to our specialty, largely superseded it in frequency of performance, because of the large number of cases of diphtheritic laryngeal stenosis occurring in the years previous to the discovery and widespread use of antitoxin. More recently, as a result of the great diminution in the number of serious cases of laryngeal diphtheria, there has occurred a marked falling off in the number of intubation cases, with the result that in the practice of many men intubation is rarely done for any purpose. Tracheotomy, on the other hand, is required no less frequently than formerly, and it is probable that as a result of improved methods of study and diagnosis the operation is relatively more frequent than it has ever been.

These conditions have led to a comparative neglect of the operation of intubation on the part of many, and although tracheotomy is by all odds the more valuable and indispensable procedure there still remain certain definite indications for the former which should be kept in mind. Both procedures are not equally efficacious in all cases nor are both on the same plane of safety and desirability in every case.

There are few cases of laryngeal obstruction in which tracheotomy will not suffice, but there are many in which it is not necessary and in which a brief intubation will prove as satisfactory and much less formidable. This is particularly true in cases of acute stenosis caused by inflammatory conditions which are likely to subside rapidly, such as the streptococcic (usually the so-called influenzal type), diphtheritic and those occurring during the course of some of the acute exanthematous diseases, chiefly measles¹ and scarlet fever. It may also apply in cases due to noninflammatory conditions, such as angioneurotic edema and local trauma from foreign bodies and instrumentation. Also in certain cases of true edema (as differentiated from inflammatory swelling so often called "edema" in the literature) resulting from constitutional causes or purulent inflammations, such as abscess in the pharynx above. Here the laryngeal obstruction is due to a mechanical interference with circulation and not to a definite pathologic condition in the larynx itself. I would specifically exclude from this class of cases all instances of laryngeal stenosis caused by a condition above in which the exciting cause could not be easily and quickly removed, as by incision and drainage of a retropharyn-

geal abscess, for the reason that sufficient infiltration of the supraglottic tissues might occur to close the larynx above the tube. In such cases the mechanical difficulties of introduction might also prove an obstacle, in which instance tracheotomy should be given the first consideration.

As examples of those cases in which tracheotomy will not suffice I have in mind the stenoses caused by pathologic conditions in the neck making tracheotomy difficult and impracticable because of local infiltration of the tissues by malignant growth or the presence of tumor masses or cervical abscess of such size and location as to preclude the performance of tracheotomy.

Of those cases in which intubation is preferable I have encountered a certain type with a sufficient degree of frequency to be impressed and to feel that its existence should be especially emphasized. This is the acute inflammatory stenosis of the larynx, due to an acute infection, usually streptococcic, and occurring most frequently during the so-called influenza epidemics. The swelling in these cases is mostly subglottic and involves not only the larynx but the tracheal and bronchial mucosa as well, frequently terminating in bronchopneumonia. This form of infection usually occurs in children up to the age of six or eight, and was mentioned in a previous paper.² Contrary to my conclusion stated in this paper, and as a result of more mature observation on a greater number of cases, fifteen in all, seen and treated since that time, I have been convinced that tracheotomy should not be the operation of choice. In these cases, complicated by lower respiratory tract infection, tracheotomy has a tendency to cause too rapid evaporation of secretion, increasing the difficulty of expulsion and prolonging the period of dryness which characterizes most of these infections in their early stages. This is due to a combination of two factors: First, to the natural dryness and lack of secretion in the early stages of acute respiratory infections in some instances, and second, to the drying effect of the direct blast of air coming through the cannula without the warming and moistening effect of the mucosa of the upper respiratory tract. This practically inhibits the action of the cilia and results in the accumulation of dried secretions at the bifurcation, with obstruction. Although we know that tracheotomy

has no such effect as this in ordinary cases, it is easy to conclude that the altered state of the mucosa and its secretions during certain types of acute infection and the interference with ciliary action make the trachea and bronchi more susceptible to the drying effect of the direct blast of air through the cannula. I have been led to conclude that this is the case by my experience in certain of these cases in which the dryness has been relieved and the patient's comfort very materially increased by the substitution of the intubation tube for the tracheotomy.

Intubation has become more practical and more easily applicable as a result of the development of direct laryngoscopy. This method of introduction affords a view of the affected larynx for study and the removal of membrane and secretions, and excludes the possibility of damage to the tissues which might occur in the older method of blind passage of the tube. This is especially advantageous in the presence of marked swelling with obliteration of the landmarks, which are at best none too easily palpable in the small, soft larynx of a child. In addition, bronchoscopy offers an excellent method of temporary intubation, affording opportunity for inspection and aspiration of the lower passages and giving ample time for selection and preparation of a suitable tube for introduction.

On the other hand, tracheotomy is the procedure of choice in the great majority of cases of laryngeal stenosis. In all cases of chronic obstruction, such as malignancy, cicatricial stenosis and abductor paralysis, it should be employed to the exclusion of all other methods wherever possible. This is also true in acute cases in which the subsequent course promises to be prolonged, such as in typhoid and other forms of chondritis, and in fractures of the larynx. In tuberculosis, syphilis, papilloma and postdiphtheritic stenosis³ it is to be preferred, particularly as laryngeal rest is an important factor in the treatment of these conditions. It was also definitely indicated in most cases of foreign body requiring relief from laryngeal obstruction, particularly before the removal of the intruder. In the hands of the unskilled, tracheotomy should be employed in all cases, as it is easier and safer for the inexperienced. In most cases of very great emergency it is quicker unless the

armamentarium and assistance are at hand for the proper performance of intubation.

In conclusion it may be said that:

Tracheotomy is the operation of choice in the great majority of cases.

It is safer in unskilled hands.

It may be done with less preparation and assistance, and hence may be quicker in certain instances.

The tube cannot be coughed out.

The tube can be worn indefinitely; but—

Tracheotomy is a surgical operation and subject to certain risks as such: Emphysema, infection, postoperative hemorrhage, perforation of esophagus, subglottic damage with stenosis.

It is impractical in certain cases.

It may predispose to drying of the tracheobronchial mucosa in certain acute inflammatory cases with obstructive accumulation of secretions.

Of intubation it may be said that:

Intubation should be employed by preference in a certain selected minority of cases.

It is simpler for the patient where practicable.

It is easier and subject to less operative risk in skilled hands.

The presence of an intubation tube is not in itself as harmful as has been frequently taught, as it may be well tolerated for a considerable length of time; long enough for an acute case to subside, in most instances; but—

Unskilled attempts at intubation may result in false passage or suffocation from abortive efforts too much prolonged.

The tube may push membrane before it into trachea with increased embarrassment.

The tube may be coughed out.

510 REPUBLIC BUILDING.

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XLIV.

PTERYGOMAXILLARY ABSCESS COMPLICATING
ACUTE MASTOIDITIS.

BY JEROME F. STRAUSS, M. D.,

CHICAGO.

Any consideration of serious complications involving and associated with acute suppurations of the ear and mastoid very naturally calls to mind those conditions wherein intensive diagnostic skill and surgical judgment are probably essential requisites to the very life of the patient. So accustomed are we to this somewhat limited list of complications that it seems presumptuous and a radical departure from accepted standards to consider as serious any local complication other than extension of the infective process into the bulb, the lateral sinus, the meningeal layers or the brain itself.

I wish to report and discuss a case which for difficulty in management, serious aspects and alarming symptomatology takes its place scarcely second to none of the more usual mastoid complications; a case in the conduct of which there was required weeks of detailed attention before it could be properly culminated.

Analysis of the course points to an extension of the otitic infection by one of the several pathways to be enumerated later, into that rarely traversed and anatomically complicated space known as the pterygomaxillary or infratemporal fossa. In a fairly thorough search through the literature we have been unable to find record of the involvement of this space in connection with otitis media or suppurative mastoiditis—indeed, any mention of the locality from a practical or clinical standpoint is extremely rare.

History of Case.—R. W. K., boy, age 8 years. Family and past history negative and irrelevant.

The patient was first seen on March 23rd with a left acute otitis media, which required paracentesis twenty-four hours later. This initial infection was decidedly not what one could

call a severe middle ear infection, and for a period of eleven days ran a usual course of gradually diminishing mucopurulent discharge and a practically normal temperature.

A note of April 4th, twelve days after paracentesis, states: "There is a slight but definite increase in the amount of discharge for the past twenty-four hours, with an evening temperature rise to 100.6°. The patient appears quite well, but has complained for a few short intervals of moderate pain around the ear. There is an edematous thickening of the drum in the area of the incision and some pouting of the wound. Though there is no rapid filling of the canal, pulsation is again apparent after being absent five or six days."

April 6th, forty-eight hours later: "The discharge is again profuse. Afternoon temperature 102°. The patient looks uncomfortable and complains of decided pain over the entire left side of the face. This pain is peculiarly exaggerated by deglutition. There is a deep tenderness over the mastoid process, more especially prominent near the tip. The canal fills rather rapidly and there is a suggestion of swelling in the posterior wall."

On April 7th, the next day, the discharge was very profuse, and the temperature ranged from 99 to 102.8 degrees. There was definite increase in discomfort in the entire left face, with centralizing localization over the middle third of the zygoma. Quoting further: "When swallowing he now screams in agony and holds his left hand so that the palmar surface exerts supporting pressure on this area. There is no great tenderness over the zygoma proportionate to this pain, but the patient winces on deep pressure. No swelling is noted in the temporal or preaural regions. There is noticeable for the first time today a decided limitation of movement of the mandible. Examination discloses the fact that the interincisor opening will scarcely admit two finger tips. Tenderness over the body of the mastoid is more marked, and there is evidence of edema in the postauricular fold. After cleansing, the external canal shows a constriction due to a flat sagging of the posterior superior wall."

A diagnosis of surgical mastoiditis with involvement of zygomatic cells was made, operation advised and consultation suggested.

April 8th. Consultation with Dr. George Shambaugh, who concurred in the diagnosis and advised operation. A note says: "Pain and tenderness greatly increased. Mandibular action practically absent, there being about an eighth of an inch separation between the incisors on attempting to open the mouth. Deglutition causes still more severe pain and is accompanied by piercing shrieks, even when the patient is under the influence of opiates. It is also found that the slightest lateral movement of the lower jaw causes similar paroxysms with either active or passive motion."

The patient was hospitalized. X-rays showed a pneumatic mastoid process which was definitely cloudy, as compared to the right side. The osseous trabeculae were apparently not broken down. White cell count, 13,400. Blood culture negative. Culture from ear discharge showed a hemolytic streptococcus.

Operation (same day, sixteen days after paracentesis), Dr. Shambaugh present and assisting. Usual preparation and incision, which was later extended upward over the zygomatic root. Mastoid cortex removed, exposing a partially pneumatized body and tip. All cells contained pus, and there was evidence of bone softening in several areas. The antrum was readily exposed and curetted free of thickened mucosa, granulations and pus. Through the upper angle of the incision the zygomatic root was opened and explored. Three small cells were found in this structure, each with normal mucosa and no evidence of suppuration. The exploration exposed an area of dura 0.5 cm. in diameter. Drains were inserted with partial closure of the skin incision.

Postoperative Course.—Following operation the situation with regard to the exaggerated symptomatology was in no way improved. Failure to discover an inflammatory focus in any of the zygomatic cells left the diagnosis still undefined. Within twenty-four hours after opening the mastoid the facial pain became rapidly more acute. Morphine, administered hypodermically, gave relief for not more than ten to twenty minutes. The patient by this time was shrieking almost constantly with pain. His sharp outcries were accompanied by restless tossing and weird delirium. Perhaps the best method of conveying an adequate concept of the clinical picture is to report that an

examination of the patient by a competent internist elicited a diagnosis of probable encephalitis.

Forty-eight hours after operation, during the dressing of the mastoid wound, the first external evidence of marked tenderness was apparent. This was located one centimeter in front of the auricle and a little above the superior margin of the zygoma. Pressure at this point caused severe paroxysms of pain.

It was necessary to administer morphin hypodermically from one to four times in each twenty-four hours, in addition to codein combined with various nonnarcotic analgesics, for a period of thirteen days following the mastoid operation, and during this time the patient rarely totaled more than two to three hours of sleep per day.

In this long period slow but definite changes were taking place. On the sixth day a slight preaural swelling was apparent. On this day the white cell count was 16,000, and a second set of radiographic films failed to localize a deep seated lesion. The evening temperature was 102° at this time. On the tenth day the swelling was sufficient to disturb the facial outline. The area could only be palpated with great difficulty on account of the extreme tenderness. The white count was now 18,000 and the highest temperature 103° .

Three days later there was definite subdermal fluctuation centering over the junction of the middle and posterior thirds of the zygoma. Preparation was made to incise for drainage, but during the struggle incident to the first stage of nitrous oxid anesthesia the abscess ruptured into the mastoid wound, filling the cavity and dressings with a large quantity of pus. The swelling having collapsed, an effort was made to locate the abscess at the point of recent fluctuation by needle, but without success.

The patient showed a marked improvement following the evacuation of pus, and hope was entertained that drainage through the mastoid wound would be sufficient to effect a cure. Within five days, however, all symptoms returned, including the severe pain and fluctuating swelling, and two days later, or twenty-one days after the mastoid operation, we were able to insert a large drain through a crucial incision into the

superficial portion of the abscess. The wound drained freely for seventy-two hours and very slightly for two more days. During this brief period there was gradual improvement in all symptoms, the pain disappearing within a week, at which time the mouth could be opened sufficiently to admit three fingers between the incisors.

Diagnosis: We have no choice but to localize the origin of this process in the infratemporal or pterygomaxillary fossa. It was obvious after the first week of the complication that pus was forming in the left face. That this was deeply situated in the temporomaxillary space is also obvious, inasmuch as any other extracranial focus must be relatively superficial. The absence of tenderness and swelling during the first ten days is further evidence that the lesion arose at a great depth in the fossa.

I am inclined to believe that the early fixation of the mandible was due to inflammatory infiltration medial and adjacent to the pterygoid muscles. Fixation occurred within a few hours after the first complaint of lateral head pain, and it will be recalled that lateral movements of the lower jaw, which action principally involves these muscles, was as painful as the simple opening of the incisors. I believe, further, that the immobility of the mandible, occurring without tenderness, pain or swelling over the masseter and temporal muscles, was not a trismus or tonic spasm, but an involuntary fixation to allow the greatest possible space for the pressure of expanding inflammatory elements in the pterygoid basilar region. Such a spontaneous postural fixation occurs in the flexion and eversion of the knee in infections within the hip joint.

The phenomenon of painful deglutition with radiation of excruciating pain to the involved side also tends to aid in the localization of the early lesion. A fair portion of the superior margin of the pharynx finds its insertion in the petrous portion of the temporal bones which form, in part, the roof of the pterygoid maxillary fossa. Inflammatory induration, pressure of exudate, etc., would react with pain to the act of swallowing and be restricted entirely to the affected side because of the firm attachment of the median raphe of the pharynx to the osseous wall.

The question of the means by which the infratemporal space can be invaded during the course of an ordinary suppurative otitis media and mastoiditis is open to wide conjecture. Hematogenous metastasis is, of course, a possibility, occurring accidentally, as is sometimes seen during the course of other infections. If this were the mechanism in the present case, it would appear to be by means of a single organism, or very few, in the blood stream, since no other foci developed, and there was no evidence of bacteremia or septicemia by blood culture or clinical picture.

Direct extension is the other alternative, and we have the possibility of diseased and ruptured aberrant cells in the digastric groove of the mastoid process or the same mechanism and pathology occurring in the cells occasionally found invading the petrous portion of the temporal bone. The latter possibility appears to me to be the most reasonable, accounting for the depth of the origin of the secondary infection where the suppurative process may be guided and retained in the infratemporal region by the superior margins of the pharyngeal wall, the musculotendinous sheaths inserted in the stylomastoid process, the pterygoid muscles, and finally and perhaps most important, the deep fascial planes involving these structures and their bony attachments.

XLV.

THE NASAL ACCESSORY SINUSES IN CARDIOPATHIES; REPORT OF CASES.*

By JOSEPH W. MILLER, M. D.,†

NEW YORK.

"In the "Archives of Internal Medicine," August, 1924, I published a preliminary report on "The Nasal Accessory Sinuses in Cardiopathies." This report was based on post-mortem findings of the nasal accessory sinuses of patients dying from cardiac disease. In none of the three cases reported was there an antemortem history of subjective symptoms referable to the involved sinus. Nor was the affection suspected by the attending physician, the three patients dying with their sinus pathology unrecognized.

The literature on the relation of sinus disease, especially sinus empyema, to various affections of the heart, is scant indeed. Practically nothing has been written on the subject prior to the publication of my paper.

In this paper I shall report several cases of empyema involving the frontal, ethmoid and maxillary sinuses in living patients with cardiac disease.

Case 1.—Empyema of the sinus maxillaris in a cardiac, without subjective symptoms referable to the sinus.

This patient, M. Y., 23 years of age, was referred to my clinic by Dr. Morris H. Kahn with a request to examine the nasal accessory sinuses. The accompanying letter stated briefly that the patient is a cardiac with a definite and distinct mitral regurgitant murmur. His family history is not remarkable and throws no light upon this case. His personal history until 1916 has been good. That year he took sick with what he calls "diarrhea" and was confined in a Boston hospital for three weeks.

*Read in part before the Beth Israel Hospital Alumni Association, March 25, 1926.

†From the Otolaryngologic Clinic, Beth Israel Hospital, New York City. Service of Dr. Samuel J. Kopetzky.

His present complaint dates back to 1920, when patient experienced a disagreeable taste in his mouth and noticed a coated tongue. Later on he developed gastric distress in the form of epigastric fullness, while recently dyspnea on exertion and pressing pains in the chest over the cardiac region became manifest. For these symptoms, he was referred to the cardiologist, Dr. Morris H. Kahn, who, during a careful examination, discovered the nasal pathology.

The patient was now referred to my clinic at the Beth Israel Hospital and assigned to Dr. Adolf Greenstein. His findings are as follows: External configuration: Small stubby nose, right side depressed. Nasal chambers and accessory sinuses: Septum deflected to the right, left nasal chamber roomy, its middle turbinate markedly hypertrophied and covered with inspissated secretion. Mucous membrane of nasal chambers pale and atrophic and streaked with stringy pus. Radiographic examination of the nasal accessory sinuses showed definite clouding of the left frontal, ethmoid and maxillary sinuses. A preliminary antrum puncture was made and very foul smelling dark gray pus obtained. Irrigations with acriflavin were instituted every other day for two months with no favorable results. We then decided to perform a Caldwell-Luc operation and a radical intranasal frontal.

This was done at the hospital on February 13, 1925. The maxillary sinus was opened through the canine fossa, and after the foul exudate was removed by suction we found a degenerated mucous membrane studded with polypi. This was thoroughly curetted, the cavity packed and closed and adequate drainage established through the nose. We next proceeded to open the frontal sinus by chiseling away the *agor nasi*, according to the method of Halle, and also removed part of the left middle turbinate. On opening the frontal sinus there was a gush of foul smelling dark gray pus, but the curette brought forth no polypi. The opening was enlarged, the nasal chamber lightly packed and the patient sent to bed. The entire procedure was performed under local anesthesia by blocking the sphenopalatine (Meckel's ganglion). An ice bag to the left cheek and ten drops of hydrogen peroxid every two hours dropped into the left nasal chamber was the only postoperative treatment. The packing was removed five days later and the

patient ordered to return to the clinic every other day for antrum irrigations. This was accomplished with a 1/10,000 dibromin sol. The patient has improved greatly since then, the discharge lessened to but a few drops, his pressing pains in the chest are gone and he is in excellent spirits.

One month after the operation he was reexamined by Dr. Kahn, who reported the following: Faint systolic blow at apex. The apex beat is seen and felt in the fifth space and falls away from his chest in lying down posture. His blood pressure is 146/86. Dr. Kahn also informed me that while his symptoms practically disappeared and the function of the valves improved, it is too early to pass a definite opinion and that the patient will have to be observed carefully for several months.

Right here I would like to lay stress on the fact that sinus disease, especially sinus empyema, may exist for years without any subjective symptoms referable to the sinus. Occasionally, with such symptoms as dryness of the throat, hawking and bringing up tenacious secretion which the patient senses sticking to the rhinopharynx, one should at once suspect sinus disease. Hoarseness is another subjective symptom frequently met with, and the laryngologist should suspect sinus disease as soon as he observes a dry posterior pharynx wall covered at times with inspissated mucopus. This picture can be traced down to the laryngopharynx, especially over the interarytenoid space into the ventricle of the larynx, over and between the vocal cords and onto the subglottic space. Hoarseness in these cases is due partly to the plug of mucopus between the vocal cords, partly to the dry rigid cords, and partly to the secretion in the interarytenoid space interfering with the free movements of the arytenoid cartilages.

Only recently such a case came to the clinic with the complaint of frequent attacks of hoarseness. Her last attack was unbearable, and she consulted us for her hoarseness and for nothing else. On examination we found a plug of inspissated mucopus between the vocal cords posteriorly. No sooner was this removed than the patient began to speak normally and thought a miracle was performed on her. This secretion trickled into her larynx constantly from her rhinopharynx. Her nasal chambers were atrophic and covered with stringy pus. X-ray of her sinuses revealed definite veiling of both

antra. The patient, however, had no complaints to make with reference to her sinus pathology.

We have in the above case succeeded in demonstrating definitely the relation of sinus disease, especially sinus empyema to cardiac disease, for the first time in a living patient. Two other cases referred to me from the cardiac clinic of the Beth Israel Hospital, through the social service department, will now be reported in detail.

Case 2. Bilateral Maxillary Sinusitis in a Cardiac.—Miss M. C., 19 years of age, was referred to my clinic on February 26, 1925. Dryness of the throat and constant postnasal discharge were her most annoying symptoms. Other complaints were occasional headaches and hoarseness.

Examination of her nasal chambers reveals a deflected septum to the right, mucous membrane swollen and purulent discharge present on the floor of each nasal chamber. The posterior pharynx wall was bedecked with inspissated secretion. The laryngeal mucous membrane was congested, the vocal cords thickened and covered with secretion.

The report from the cardiologist, Dr. Morris H. Kahn, stated that "she has had frequent attacks of tonsillitis with a tonsillectomy five years ago. She has had rheumatic pains for years, both before and since the tonsillectomy. Her nasal infection dates back ten years or more, and for seven years she has been attending the cardiac clinic at Beth Israel Hospital.

She complains of dyspnea and palpitation on moderate exertion and at times sticking precordial pain.

Physical examination shows the heart very much enlarged. The right border is $1\frac{1}{4}$ inches from the middle line and the left border 5 inches from the midline. The apex beat is in the fourth space $3\frac{1}{2}$ inches from the midline. At the apex there is a blowing systolic murmur heard faintly at the left axilla and in the back of the left chest. It is more marked over the pulmonic area and aorta and is transmitted into the vessels of the neck. There is no diastolic murmur. A systolic shock of the apex suggests the auricular stenotic thrill, but there is no presystolic murmur. In the lying down position there is a systolic blow at the apex, slightly musical in quality. The blood pressure is 160/60.

My diagnosis is hypertrophied heart, mitral regurgitation and lesion of the aortic valve, both of the rheumatic type. The source of the origin of this endocarditis is without doubt the sinus infections."

X-ray of the sinuses revealed clouding of both maxillary antra. A preliminary submucous resection of the nasal septum was done on March 2, 1925, and both antra punctured through the inferior meatus on March 23, 1925. This was accomplished with a straight trocar and canula. The trocar was then removed, and through the canula a straight suction tube inserted and free pus removed.

Holmes' nasopharyngoscope was then pushed through the canula and each antrum inspected separately, according to the methods devised by Skillern and Spielberg. The mucous membrane of the sinuses was found to be very congested; pus was seen on the floors but no polypi.

Daily sinus irrigations for two months with a weak iodine solution or a mixture of peroxid and water brought an end to the discharge and to her nose and throat symptoms.

The social service department sent her to the country for two weeks, whence she returned markedly improved.

Case 3.—Frieda R., 18 years of age, was first admitted to the Beth Israel Hospital on February 26, 1925, with a diagnosis of chronic endocarditis, mitral stenosis and cardiac decompensation.

Her complaint on admission was dyspnea and swelling of the feet. She had pneumonia at eight, rheumatism three and five years ago, respectively, and "heart trouble" for five years. She has been visiting the cardiac clinic for the past five years and spent two and one-half months in the hospital three years ago.

Physical examination finds the heart enlarged, mitral stenosis, edema of both ankles and rales at both bases. The X-ray reveals cardiac enlargement to right and left. Her blood pressure is 120/74, temperature 98-99, pulse 84-90 and respiration 24. The other laboratory findings are not remarkable.

At the request of the internist, Dr. Almour examined her nose and throat, and reports the following: Marked septal deflection and pus in both nares. Advise X-ray of sinuses. This

advice was not carried out, and the patient left the hospital, apparently improved, on March 7, 1925.

On November 29th she was readmitted to the hospital and gave the following interval history: Discharged nine months ago, feeling well until two months ago, when patient caught "cold," but despite her cough was able to work until three weeks ago, when she had to take to bed. Since then her cough has increased, she became dyspneic and developed edema of the lower extremities. She has been taking digitalis all the time.

Her temperature ranges now from 99 to 104, the pulse from 100 to 130, respiration from 30 to 56, and the blood pressure is 110/72. The urine shows albumin 2 plus, hyalin casts and occasional r. b. c. and w. b. c. Blood culture is negative.

A request for a nose and throat examination was made, and I examined her on December 24, 1925. My findings are: Pharynx wall roomy and covered with purulent secretion, the right nasal chamber is narrow, septum deflected to the right and pus pouring down from the middle meatus. Advise X-ray of sinuses.

But the patient now was too ill to be X-rayed. "A roentgenogram taken of her chest on November 30th with a portable machine did not give a satisfactory result to allow of a definite opinion." The radiographer advised a reexamination after improvement of the patient. So it was entirely out of the question to X-ray her now while she was in a moribund condition. The patient died on January 15, 1926. Examination of the nasal accessory sinuses postmortem revealed the right maxillary sinus filled with thick greenish pus. All the other accessory sinuses apparently were negative.

Three children with heart disease, sent to my clinic from the social service department, Beth Israel Hospital, give definite clinical signs of maxillary sinus suppuration, which are corroborated by repeated roentgenologic examinations. These children have been attending the cardiac clinic for various periods and are now under investigation and treatment in the otolaryngologic clinic. Two of these children had their tonsils removed, but the tonsillectomies did not improve their cardiac condition.

268 EAST BROADWAY.

XLVI.

THE EAR, NOSE AND THROAT IN ITS RELATIONS
TO GENERAL MEDICINE.

BY A. HARRY RUBENSTEIN, M. D.,

SYRACUSE, N. Y.

The close association existing between general medicine and the diseases of the ear, nose and throat are more generally acknowledged today than ever before. That day is probably gone forever when the assistance of an ear man is called for only when there is some definite symptom referable to the local area. The intricacies of the human mechanism are too closely woven to allow a continuation of the past abridgment of the otorhinolaryngologist from the general medical man.

The purpose of this paper is to take up, not in detail any one disease, but rather to direct attention to the great number of diseases which are in some way related to this specialty. In a few instances the writer will attempt to illustrate by briefly citing some case histories. For the sake of brevity, he will omit all negative findings. Stress will be directed upon not only diseases as entities, but there will also be mentioned certain symptoms, such as vertigo, headache, falling sensation, etc.

Vertigo.—It is now generally conceded that the ear is a most important organ in the maintenance of equilibrium. Quite true, vision and muscle sense are important factors, yet the kinetic static function of the labyrinth is of paramount importance. The triad of vision, muscle sense and kinetic static sensation allows us to make estimations of orientation and locomotion, estimate the rate of motion, of weight, and to realize our posture and our position. With these facts in mind, the symptomatic complaint of vertigo will be discussed.

It is not stated amiss that the average practitioner is at the very most only guessing at the clinical significance of this complaint. So often is it spoken of in such indefinite terms as gastric, or intestinal vertigo, or due to refractive errors, or a nephritic, or neurasthenic or hysterical state. None of these

per se are capable of causing vertigo. Every vertigo, be the etiology what it is, is caused by some stimulation affecting the labyrinth or the brain centers. Vertigo is caused by organic lesions of these centers or toxemic stimulation.

The definite specific reactions which follow the stimulation of these centers by means of such tests as the Barany, the caloric and the galvanic reactions, include or exclude involvement of the labyrinth, the tracts to the brain centers and centers proper, with such certainty that no diagnosis of vertigo is complete without them. It is not meant to be implied that all cases with this complaint can be diagnosed by means of these functional tests, yet by their exclusion can a definite diagnosis be more easily arrived at.

The Ear in Neurology.—The definite responses elicited by the functional tests are so conclusive that no neurologic examination is complete without them. What the Wassermann reaction is in syphilis are the labyrinthine tests in neurology. Headache, vertigo, nausea, falling sensation, optic neuritis, nystagmus—in fact, practically all of the intracranial symptoms—are so closely related to the labyrinthine cerebellar routes that it should be imperative that these tests be performed. Tumors of the brain, especially if along this pathway, can be localized, and the differentiation between peripheral and central lesions is almost absolute. Regarding nystagmus, here again the type of nystagmus—is it vestibular, is it intracranial, is it ocular, is it a nystagmus of multiple sclerosis? All, if not clarified, are at least excluded.

The diagnosis of the hysterias, with all of their simulating factors, are frequently cleared up through the otolaryngologist.

Surgery.—Now just a few words regarding the surgeon. In all of his contemplated intracranial work, it should be absolutely required that the function tests be performed.

Cough.—An undiagnosed cough, especially if there are negative pulmonary findings, is always suggestive of a possible otorhinolaryngeal focus. It is not infrequent that a prolonged cough has its etiology in a discharging sinus:

Mrs. R., age 43, complained of a cough lasting over a year: cough most prominent when lying down. Examination showed a double ethmoiditis, with nasal polyps. Treatment directed to the cause cleared symptom almost immediately.

Chronic cough, due to laryngeal nodes or papillomas or thickened cords, is called to your attention. Likewise is the cough due to chronic pharyngitis and hypertrophied tonsils mentioned.

Elongated uvulæ were formerly much blamed for the hacking cough, but today it is generally recognized as not the culprit it was considered. Yet occasionally we do meet with such a case:

Mr. B., age 17, complained of a cough of one year's duration. The uvula was definitely hypertrophied, and rested on the base of his tongue. Removal of the tip cleared his cough.

Impacted cerumen causes reflex cough through irritation of Jacobson's nerve. Experimentally this can often be elicited by cleaning the external canal of a discharging ear.

Gastrointestinal.—The following case history illustrates the possible involvement of the gastrointestinal tract, due to ear pathology:

Mr. A., Armenian, age 20, had been complaining of nausea, vomiting and slight vertigo. These attacks occurred with no relationship to his meals and dated back about three years. Unsuccessfully he had been treated by some of the most prominent physicians in the city. He visited the writer because of epistaxis. The ear discharge was so little and the condition was considered of such little importance that no mention was made of it. The membrane was entirely destroyed, and protruding into the canal was a cholesteatomatous mass. While cleaning his ear there was precipitated one of his typical attacks of so-called stomach trouble. This boy had a circumscribed perabyrinthitis, and besides not being diagnosed actually was in a very precarious condition. His response to treatment was good, but only recently did he return, complaining of the same symptoms. Operation was refused.

The gastric symptoms, arising from a discharging sinus, are being mentioned to you.

Syphilis.—The eighth nerve is very susceptible to injury. The toxins of the *spirochetæ pallida* have a special predilection for this nerve, especially the auditory portion of it. Very early is it involved in cerebrospinal lues. Beck, of Vienna, was

the first to bring forth the observation that deafness caused by lues gives a shortened Schwabach. This test, the comparison of bone conduction of the patient and physician, if the latter has a proved normal hearing, is of great importance, and any shortening of over six seconds is interpreted as being caused by some pathologic state. The luetic, in the majority of cases, will react to a shortened Schwabach.

Mrs. S., age 40, was complaining of hoarseness of three months' duration. Her history regarding her ears was negative. Her laryngeal examination revealed an involvement of her cords suggestive of either a tuberculous or syphilitic condition. Her auditory acuity was diminished about 50 per cent. Schwabach on both ears was shortened, on repeated tests, eight to ten seconds. Wassermann was reported four plus on blood and three plus on spinal tap. Following her course of antiluetic treatment, as a matter of fact, during the course of this treatment, her hoarseness cleared.

A further discourse on syphilis need merely be abbreviated by calling to your attention the frequency of luetic laryngitis, secondary lesions of the throat, luetic perforation of the septum, sloughing of the inferior turbinate, gummas of the nose and throat. A very characteristic luetic finding is the redness of the hard palate with the almost abrupt demarcation of the pale soft palate, giving an appearance like the sunsetting.

Tuberculosis.—As with syphilis, so with tuberculosis, is the larynx or the ear often the one and only organ giving objective symptoms. Why this is so the writer is unprepared to answer, but it is a fact that frequently when the patient gives absolutely negative findings to a chest examination, yet in spite of this there will be a chronic otitis or laryngitis of tuberculous etiology. It is not meant to be implied that these are original foci; such is not believed, but they give us our clue when nothing else does.

Asthma.—The following case history will exemplify a possible relationship of the nose and sinus to asthmatic attacks:

This patient, a female, age 34, had been diagnosed as asthmatic by a score or more of physicians. Whatever asthma is, the writer is sorry to state that he does not know, other than that it is a symptom complex, which the patient expresses, and

which on examination reveals certain characteristic chest signs. Anaphylactic reactions, arterial spasm, bronchial spasms and other etiologic factors are frequently mentioned by various writers. It is the author's opinion that asthma deserves no more entity as a disease than is given to the symptom "pain." It apparently is a peculiar phenomenon, caused by many different factors and expressed by certain objective and subjective symptoms.

This patient, Mrs. M., visited the writer because she had asthma and because someone told her that perhaps her trouble might be caused by her sinus. That someone was not a physician. She previously had received vaccine treatment, protein injections, had had a submucous resection and had the usual symptomatic treatment.

Her nasal examination showed a seromucous discharge in her nostrils, but more prominent on the right side. Her mucosa was congested and all of the turbinates were swollen to the degree that nasal breathing was impossible. On attempting to wash out her antrums fluid could not be forced through. X-ray examination showed a cloudy left and right antrum; greater cloudiness on the right side; right ethmoids cloudy.

After reattempting to wash out her antrums, a radical right antrum operation was performed. On opening her antrum, a thick jelly like necrotic mass of polypus tissue was found; this had so filled the cavity that it explained fully the cause of the unsuccessful washings. Subsequently the asthmatic symptoms improved, and following a second operation, exenterating her right ethmoid cells, which were found filled with hyperplastic tissue and polyps, her asthma entirely disappeared. She recently had an acute rhinitis involving mostly her left nasal cavity; there was a flaring up of her asthmatic symptoms; under palliative treatment this disappeared, but the day will come when her second antrum will require radical attention.

Headache.—The headaches so perplexing to diagnose can often be traced to a hyperplastic sinus or a vacuum sinus.

Focal Infection.—Infection from the sinuses, tonsils and the general lymphatic tissue of the nose and throat is an accepted fact, and the cases which are seen daily prove this beyond a question of doubt. Metastatic infections causing arthritis,

endocarditis, rheumatism, septicemia, etc., occur so often that examples would be superfluous.

The above enumeration is far from a complete one, but serves to impress one with the wide range of ways in which the otolaryngologist might add his assistance in clearing up perplexing cases. The diagnostic assistance of this branch of medicine is far too valuable to be used for the mere surgery attached to it, and it is hoped that the future will find that the men doing this work will be employed not merely for operative purposes but for diagnostic purposes as well.

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*"Equilibrium and Vertigo," I. H. Jones.

XLVII.

SCARLET FEVER OTITIS; A REPORT OF SIXTY-SIX CASES.

BY ANNA B. LEFLER, M. D.,

LOS ANGELES.

Scarlet fever as a frequent cause of deafness is to be regretted. Ellison Ross,¹ in reviewing his summary of literature on scarlet fever as cause of chronic otitis media, gives this table:

"SCARLET FEVER AS A CAUSE OF CHRONIC OTITIS MEDIA."

Authors	No. Cases Otitis Media	No. Cases Due to Scarlet Fever	Per Cent Otitis Due to Scarlet Fever
May-Schmalz	2,500	137	5.50
May-Yearsley	544	27	5.00
May-Burkhardt	1,950	85	4.33
Marian-May	5,613 D. M.	572	10.18
Bezold	623	89	14.30
Bezold	714	103	14.40
Sprague-Blau et al.....	4,045	55	3.90
Weil-Burkhardt.....	4,309	488	11.30

and concludes "that approximately 4 to 15 per cent of all cases of chronic otitis media are due to scarlet fever." He gives May's report on 5,613 deafmutes, in 10 per cent of whom deafness was due to scarlet fever.

A few years ago Cook County Hospital placed on their scarlet fever service men competent to examine ears, which was done routinely every four hours.

Early paracentesis was their order, not waiting for complaint of pain or rise in temperature. In their series they had one mastoid operation and dismissed no discharging ear.

STANDARD TAKEN.

At the Los Angeles General Hospital our standard is that every scarlet fever patient developing an ear complication shall go out not only with a dry ear but an intact tympanic mem-

brane. If we fail with any patient, we wish to know why we fail. Strict asepsis, early paracentesis under a local anesthetic, which also disinfects the drum and canal, followed by ether drops twice daily, is the rule. When the patient enters, the ears are examined by the intern and resident physician. Examinations are repeated if the patient has prolonged temperature, rise in temperature or complaint of pain. Ear clinic is held twice a week by the attending staff, consultations are willingly given, operations are done by otologists especially interested in mastoid work. The scarlet fever ward is a potential school in conservation of hearing. The aseptic methods of a contagious hospital are important in teaching of both nurses and interns, and probably more vital in the outcome of an ear than usually recognized. Many of them go out to public health work, where they will have influence. Interns study early changes in the tympanic membrane, and perform both postmortem and clinical paracentesis.

Los Angeles General Hospital, January 15, 1925, to July 15, 1926.

Scarlet Fever Alone.—One patient (F. N.) was admitted with acute mastoiditis on the twenty-eighth day of scarlet fever, for a simple mastoid operation, which was done immediately. Two patients with chronic otitis media entered with scarlet fever; one (Pott's disease) was returned to the Orthopedic Hospital with a request that his ear have attention; the other, previous bilateral mastoid operations, released to enter the general ear clinic for radical mastoid operations.

Of 473 cases, 58 patients, or 12.25 per cent, developed ear complications. Two of these died; otitis was not the cause of death. Two required mastoid operations (one bilateral) due to continued or intermittent discharge. With but one exception (congenital lues) the other 53 left the hospital with healed tympanic membrane; hearing good.

Scarlet Fever With Diphtheria.—One patient entered with discharging ear; operated upon later for intermittent discharge. Of 18 cases, 7 patients, or 38.88 per cent, developed ear complications. Three left the hospital without consent. Two had mastoid operation as emergency procedure. One had mastoid

operation for continued discharge. One left with tympanic membrane healed; hearing good.

Of these two groups there were 66 patients entering with tympanic membrane intact who developed otitis media. One patient, or 1.5 per cent, had bilateral failure to heal spontaneously. Eight patients, or 12.12 per cent, had monolateral failure. Fifty-seven patients, or 86.35 per cent, healed spontaneously.

Following are the records of the above nine failures with our criticisms:

GROUP I.

Left hospital without consent of the ear staff.

R. M., age $2\frac{1}{2}$ years, entered the seventh day of scarlet fever and diphtheria. The thirty-ninth day of his illness he complained of pain in left ear; paracentesis was done. The following day spontaneous rupture of the drum of right ear occurred. On the sixty-fifth day of his illness he left the hospital to be quarantined at home. A year and one-quarter later right ear was discharging; tonsil and adenoid operation again refused; mastoid operation not considered by parents.

Criticism: Failure to lance right ear. Failure to secure parents' consent for operation. Failure to impress health officer with danger of home quarantine, as patient's sister contracted scarlet fever, with bilateral chronic otitis, deafness resulting.

R. C., age 21 years, entered the fifth day of scarlet fever; complained of pain in right ear on the thirteenth day of her illness; myringotomy was done the fourteenth day. Examination by the tuberculosis staff gave no evidence of disease in lungs. Deter's test very slightly positive. Wassermann test negative, but history of congenital lues given by family physician. On the seventy-fourth day of her illness, when she left the hospital, there was slight discharge present in the right ear.

Criticism: Delayed paracentesis. Failure to elicit history of lues and institute specific treatment. Mastoid operation should have been considered.

B. A., age 6 years, entered the fourth day of scarlet fever and diphtheria. Bilateral paracentesis was done the fifth day of her illness. She left on the sixty-fifth day of her illness,

the left ear healed, the right ear discharging. Examination the fifth month, the right ear was discharging. Tonsil and adenoid operation advised but refused.

Criticism: Failure to lance right ear before bulging occurred. Necessity for tonsil and adenoid operation, with mastoid operation later, should have been anticipated and parents' consent gained.

E. M., age 7 years, entered the third day of scarlet fever and diphtheria. Bilateral paracentesis was done on the day of entrance. The tuberculosis staff reported no evidence of disease of lungs. Some tracheobronchial glandular enlargement but probably not tubercular. Deter's test essentially negative. The left ear healed; the right ear was discharging on day of leaving hospital, the ninety-first day of his illness. Tonsil and adenoid operation refused by parents. Mastoid drainage not considered by parents. Examination eight months later: Scanty but dirty discharge in canal; perforation has increased in size until only margin present. Patient was referred to General Ear Clinic again and tonsil and adenoid operation urged.

Criticism: Tonsil and adenoid operation, with mastoid operation later, should have been anticipated and parents' consent gained.

GROUP II.

Acute mastoiditis; operation.

R. G., age 6 years, the day of beginning scarlet fever and diphtheria not known. On the third day left ear bulging, myringotomy; on the sixth day right ear bulging, myringotomy, which later healed spontaneously. The twentieth day left mastoid tender; temperature 104; simple mastoidectomy. Pus exuded under pressure when cortex was opened; pneumatic cells filled with pus and granulations. Dismissed on the sixty-first day with mastoid wound and tympanic membrane healed. After a week at home he had a cold; left ear discharging. On the eighth day his aunt developed scarlet fever, possibly due to contagion from his ear. Three months after mastoid operation, wound was opened; tonsils and adenoids removed on ac-

count of recurrent sore throat. A month later no drainage; small opening in posterior wound.

Criticism: Failure to lance ears before bulging occurred. Failure to remove tonsils and adenoids before dismissal from the contagious ward.

M. F., age 8 years, entered the fourth day of scarlet fever and diphtheria. Rise in temperature on the eighteenth day, bulging left drum; myringotomy. Paresis of the left facial nerve appeared on the thirty-sixth day. Simple mastoidectomy (left). Mastoid was found to contain pus under pressure; abscess cavity extending to antrum; neither sinus nor dura exposed. Facial paresis disappeared by the thirtieth day after operation and patient was dismissed the sixty-seventh day of her illness with tympanic membrane and mastoid wound healed. Subsequently lymph node posterior to mastoid incision swollen; opening was made through old wound.

Criticism: Ear should have been lanced before bulging occurred.

GROUP III.

Operation for continued discharge.

A. G., age 3 years, entered the fourth day of scarlet fever and diphtheria. Paracentesis of left ear the twelfth day; spontaneous recovery. Paracentesis of right ear the eighteenth day. Examination by tuberculosis staff, report being negative. Tonsils and adenoids removed a month before the mastoid operation (right), which was done on the one hundred and ninth day of her illness. Modified radical operation (right) performed. Large pneumatic type of cells found filled with granulation tissue with pus and granulations in the tympanic cavity. Necrotic bone and incus removed. Healing prompt; dismissed the one hundred and thirty-second day of her hospital residence.

Criticism: Failure to lance right ear before child complained of pain. Improvement in general condition following tonsil and adenoid operation demonstrated that it should have been done earlier.

M. T., age 2½ years, entered the fourteenth day of scarlet fever. Spontaneous rupture of right ear the fifteenth day; of

the left ear the twenty-third day of her illness. Examination by tuberculosis staff discovered no evidence of tuberculosis. Child cried during examination. Bilateral mastoid operation on the eightieth day of her illness. Simple mastoidectomy, bilateral. Right cortex was perforated; mastoid cells necrotic and filled with granulation tissue and pus. Left cortex wall intact. All cells necrotic and filled with granulation tissue and pus. Lateral sinus was uncovered. Mastoid wounds were kept open with difficulty, but ears continued to drain. Left on the one hundred and thirtieth day of her illness, with the consent, but against the desire of the ear staff.

Criticism: Failure to perform paracentesis. Failure to warn house staff to keep mastoid wounds well open. Failure to remove tonsils and adenoids.

E. P., age 11 years, entered the first day of scarlet fever. The right drum was bulging. The left was congested. Myringotomy was done on the right ear; paracentesis on the left ear. Tonsils and adenoids removed on the twenty-seventh day of illness. The left tympanic membrane healed, but right ear continued to discharge. Tuberculosis staff reported chest negative for tuberculosis. The thirty-fifth day mastoidectomy was performed on the right side and periosteum found slightly adherent; cortex intact; mastoid cells filled with granulation tissue; a polyp about the size of a pea in the mastoid cavity; pus in mastoid antrum. Patient was dismissed the seventy-ninth day with a large perforation; ear dry.

Criticism: Delayed paracentesis in right ear.

GROUP IV.

These patients were not included in the previous groups, as their ear complication was present when they entered.

F. N., age 4 years. Right ear pained on the fifth day of scarlet fever; was lanced by attending physician. Entered contagious hospital the twenty-eighth day for mastoid operation, with ear discharging, swelling over mastoid and moderate rise in temperature. Simple mastoidectomy right side; cortex perforated; subperiosteal abscess; acellular type of mastoid; pus and granulation tissue in mastoid antrum. Patient dis-

missed the twenty-seventh day following operation. Wound healed; ear dry, but perforation present; hearing good.

H. R., age 4 years, entered the fifteenth day of combined scarlet fever and diphtheria, with right ear discharging. Parents state ears discharged at 6 weeks of age. Tonsil and adenoid operation at 13 months by Dr. Baum of Denver, on account of discharging ears. Report from tuberculosis staff: "Strongly positive Deter test. Slight tracheobronchial glandular involvement, but no activity in the lungs present." The eighty-second day of his illness, or sixty-seventh day in the hospital, simple mastoidectomy was done. Right cortex was intact; cells filled with granulation tissue; necrosis around mastoid antrum. Dismissed on the eighteenth day after operation; ear dry; perforation present. Four months later, drum was healed, with no evidence of old perforation; hearing normal. .

CONCLUSIONS.

Our eighteen months' experience has brought us to these conclusions:

Early paracentesis, with strict asepsis following, as well as at time of paracentesis, lessens the seriousness of ear complication.

Diligent attention by the ear staff to their problem in scarlet fever increases the confidence of the health officer and the pediatrician. Their influence is vital: the health officer in restraining those with discharging ears from going home to spread infection; the pediatrician in choosing the time when the patient is best fitted for mastoid operation.

Consent of parents to a mastoid operation as an emergency procedure is easily gained; but consent to an operation to cure a discharging ear when the patient has recovered from a critical illness is difficult. Anticipation of this period by the ear staff develops the interest of the parent concerning the child's ears and hearing. Consent for operation is then given when needed.

Reporting these cases to the school principals or teachers should be as much a personal matter as is possible. They

should be advised that the child be sent home when he has a cold; that he be excused from attendance in severe weather; that any evidence of recurrent otitis or lessening of hearing receive prompt attention.

Segregation of scarlet fever patients in the modern contagious hospital, with better attention to the ear than we have reported, will definitely reduce the final ear pathology.

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XLVIII.

REFLECTIONS ON THE HAZARDS OF NASAL
SURGERY IN THE PERSON WITH
SENILE CHANGES.*

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Under ordinary conditions, the two extremes of life present the greatest hazards to surgery. Procedures which would be quite simple for the young adult appear altogether different when applied to the infant or to the aged. The hazards attendant upon infancy are seldom lost sight of. The very helplessness of the babe impresses one, instinctively, with the need for caution when surgery is indicated or considered. It is at the other end of the scale that we are apt to err more frequently. Sometimes we may have too much faith in the number of years lived by the patient as an index of his age.

It would seem that there might be some analogy between what we call senility and the degenerative diseases of the cardiorenal, or circulatory type. In both we have vascular changes as the predominating pathologic factors. The typical senile case usually shows arteriosclerotic changes. These changes are oftentimes premature. Perhaps these presenile cases offer the greatest hazard of surgery, because they are too frequently unrecognized. Routine or cursory examination may fail to bring out facts about the patient, certain weaknesses in his defense, which we should know and which might stay our hand or at least direct it along more conservative paths. Perhaps the greatest tragedies come in these cases which are not recognized. Most of us, if we review our past experiences in a conscientious manner, can recall occasions when a little more conservatism would have saved us a whole lot of anxiety and spared the patient considerable danger, to say the least. We all recognize the need for caution, for conservatism, in the

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aged. I fear we sometimes overlook the fact that we are dealing with a case which may be actually, if not chronologically, in this class. In our enthusiasm we may only see the apparently indicated surgery and the benefits that would accrue from it under ordinary conditions.

A person beyond the prime of life with obvious or potential senile changes desires or has been advised to have some existing nasal pathology eliminated. Admittedly not the best of risks, what course should be pursued? Those cases in which the operations are those of necessity, performed to save life, need not be considered here. Likewise the question of malignancy is not within the scope of this paper. The operations to be considered are those of election, and where there are time and need for calm reflection as to the advisability of such procedure. Each such case would have to be decided on its own merits. No class of cases requires more careful study and conscientious thought; and only if we are thoroughly cognizant of the condition of the patient can we arrive at a decision with any degree of wisdom.

If the nasal pathology is a factor in any general degeneration, it must be as a focus of infection. We must consider whether these degenerative changes are due to focal infection or to other more obscure causes, such as faulty habits of long standing, of diet, etc. Opinions vary on this, some men being inclined to put more stress upon the significance of focal infection than others. A careful history of the individual case should give us an index of the importance of the nasal condition in the etiology of the general process. However, in many cases the cause of the degenerative disease will remain obscure and any condemnation of the nose as more than a contributory factor may be hardly warranted.

If we admit that nasal pathology may be a factor as a focal infection, can we hope to remedy this already established process by the elimination of this focus? This would seem hardly possible, for once these changes, which are mainly vascular, occur, there is little likelihood of restoration to normal. Quite possibly, however, there might be improvement if the process has not gone too far. Here it is a question of judgment as to the extent of the process, the dangers inherent in it and the

possibility of improvement. With this in mind, there may be ground for considering operative procedure.

We must consider the amount of local trouble caused by the nasal lesion. Obstruction from polypi, sinus headaches, frequent and severe acute exacerbations, excessive discharge, the distress attendant upon a severe asthma, or the possibility of optic nerve involvement may seem to urge the advisability of some attempt at alleviation. The personal characteristics or the occupation of the patient may be an important factor and serve to aggravate these symptoms to an almost unbearable point. Their very severity, the cross they may be for the patient to bear, may become an argument for operative procedure.

Would the contemplated procedure be worth while? Not only must we think of the severity of the symptoms and the chances for help, but we must consider also the reasonable expectancy of life of the patient, endeavoring to see to it that we do not lessen this by any overenthusiasm for surgical activity. Sometimes the risk varies with the economic status of the patient. For instance, one could not take as much chance, even if fairly slight, with the sole support of a family.

Obviously, the most important question is that of safety. Can the patient go through the contemplated operation with reasonable safety and will he be able to enjoy the benefits long enough afterwards to make it worth while? In the presence of degenerative changes making the risk obviously hazardous, the answer is plainly negative. Everything depends upon obtaining a thorough and correct survey of the patient. This is the crux of the whole situation.

The physical condition of the patient, not his age, must be the deciding factor. Here is where a good, conscientious internist is both our guide and our refuge. There is nothing quite so all essential or so consoling as to have a reliable internist to depend upon. Dean¹ says, "The decision (as to operation) should be made by the internist and not by the otolaryngologist." Loeb² says, "A good internist is a powerful help in the estimation of the patient's reaction. He has saved and will save many a life for the surgeon." Lawrence³ writes, "This

risk (of operation) may be minimized by careful individualization in the cases selected for operation." But we should see to it that the internist always has ample opportunity to study the case, not simply a few minutes or a half hour prior to operation. This will take time, if done properly, and days rather than minutes should be allowed for this purpose. All too frequently in these possibly only suspicious cases the pre-operative preparation consists of a routine heart, lungs, urine and blood pressure examination by a house officer or the family physician. Can we hope to bring out all the needed data by this means? We need the greatest diagnostic skill and experience available, if we are to play fair with these cases. The internist, realizing the responsibility placed upon him, will be guided accordingly and will usually keep on the safe side, as he knows that in case of doubt a negative answer is less apt to bring later regret.

Another valuable source of information is the ophthalmologist. It was only after I had received reports of the presence of arteriosclerosis from findings in the fundi, in two cases after operation, when the internist had failed to note any significant degree of such trouble, that I realized that I had neglected the best means of ascertaining the condition of the blood vessels. A routine fundus examination in all suspected senile cases may be most useful.

Undoubtedly the anatomic relations of the blood vessels and the very proximity of this region to the cranial cavity render intranasal surgery in the senile somewhat more hazardous than in other parts of the body. The intimate connections between the vessels supplying the accessory sinuses and those of the dural membranes make the danger of intracranial complications more obvious. The abundance of the lymphatics and their communication with the lymphatic spaces enclosing the branches of the olfactory nerves and communicating with the subdural and subarachnoid spaces constitute another source of danger. The effect of trauma or of shock, incident to operation, with the possibility of hemorrhage into the internal capsule, must be considered. From the bone being more brittle in the aged, there may be more danger of fracture with extension of infection, although it would seem that any force sufficient to fracture even the senile bone would quite probably

be productive of trouble in any patient, no matter what the age or condition. We always have confronting us the grave dangers inherent in the ethmoid, and, as Mosher says, should always keep the fear of God in us, as regards this region.

Then we must consider whether or not any other course than an operative one might do just as well, or better, for the patient. Some form of palliative treatment, the use of suction, radiotherapy or possibly the removal of polypi might offer reasonable improvement and with far greater safety. Perseverance tempered with judgment is necessary here. Change of climate or of occupation may afford the desired relief, and, when the economic status of the patient renders this possible, it might be tried without any great degree of risk. Sometimes it is most difficult to convince a patient of the wisdom of such a course. If such a course would seem to offer a good chance of success and it is at all possible to accomplish it, it would seem wise not to tempt fate by rushing into surgery.

Assuming the operation is in trained hands and to be correctly performed, what constitutes the greatest hazards in nasal surgery in these cases? There is no doubt of the tremendous hazard of a general anesthesia so obvious that there should be no question as to the advisability of employing a local anesthetic. Hemorrhage, always likely to be a disturbing factor in intranasal operating, may be even less easily controlled in the person with sclerotic vessels. But it is the secondary hemorrhages in these cases that seem to give the most trouble and sometimes they are the most difficult to control. Local measures may seem ineffective, and the possible necessity of carotid ligation must be kept in mind. Insistence upon absolute quiet and rest in bed for a considerable period after operation perhaps furnishes the best safeguard for this troublesome complication, and if it does occur, we may console ourselves with the thought that it is preferable to have the hemorrhage in the nose rather than intracranially.

The use of adrenalin in the nose during the operation may be a source of danger, as it is quite certain in these cases to cause a local rise in the cerebral pressure, with possibilities of trouble. There seems to be no doubt that the greatest danger is from intracranial hemorrhage and embolism. The possi-

bility of a slight shock with grave results should never be lost sight of. The very condition of the vessels predisposes to this complication and the use of adrenalin favors it. Apparently we have the same risk of meningitis here as we have in any sinus case, always to be thought of, but not especially increased by these existing conditions.

And then we always have to think of the general resistance of the patient and whether he will stand the punishment of the operation. Despite the most careful estimate the myocardium may fail to stand the strain imposed upon it, or the kidneys may shut down. We should have a constant eye upon the patient and be ready to desist our efforts at the slightest sign of trouble. His constitution is already laboring under the load of his disability. We must be careful not to add more than he can carry.

Provided operation is deemed advisable, in a case of this type, what precautions should be taken? Hospitalization for from four days to a week or more, during which time he will be under the observation and care of the internist. Lawrence says, "People with arteriosclerosis do not stand sudden changes well, and I believe it is far safer to make no change in their mode of life before operation unless there is sufficient time to make the change a gradual one." During this period something may develop or be brought out which will give an entirely different conception of the case and make us revoke or postpone our decision to operate. We can be fairly sure of avoiding operation in the face of some acute infectious process or of an acute exacerbation of an old one. He will be studied and put in the best possible shape—a definite program of adequate fluid intake may be instituted. If indicated, he may be digitalized during this period. Then if it still appears safe, we may proceed with the operation. Local anesthesia, fortified according to the method of Gwathmey, with synergistic and rectal analgesia, by eliminating the discomfort incident to the best purely local anesthesia, seems to lessen the shock to the patient. This method was first employed in obstetrics but is now being adapted to work in other fields. Dr. Arthur McQuillan, formerly at the New York Lying-In Hospital, brought this to my attention, and I have been fortunate in having his supervision in its administration. While still in the preliminary

stage and not finally perfected, the results seem to be most promising. All the suffering and shock we can spare these cases, the better the chance of success.

Another precaution which is worth while is to have the internist in the room during the operation, to observe at all times the condition of the patient. He will be far better able to note unfavorable, distressing signs and to order such treatment as his judgment indicates. He should not hesitate to suggest stopping the operation at any time, and his advice should always be followed. The operator will have in mind the need of a conservative course, of doing as little as necessary to achieve the purpose, but the presence of the medical man will surely act as a brake if needed. Then the necessity of a short operating time should be remembered. This is always an advantage in all cases, meaning less shock and less devitalization of tissue. In no class of case is it more urgently required than in these under discussion. The last precaution would be, of course, to keep the patient quiet in bed and in the hospital until all ordinary risk of complication had passed. During this period the internist is still the most important member of the team: for, as a rule, unless local complications arise, the less the otolaryngologist disturbs the patient, the better. Rest is all-essential. The same rigid supervision of the bodily functions as before should be kept up until all reasonable danger of trouble has passed.

CONCLUSIONS.

It would seem that operation may be indicated in this type of case if there appeared to be a good chance of improvement in the general process, or of relief from severe and irritative local manifestations of the nasal pathology, sufficient to warrant interference, if it is economically wise and other measures will not serve as well; provided, if from most careful medical study it is considered reasonably safe.

Decision as to operation—if and when—should be made by the internist.

Cases should be hospitalized, under the observation of the internist, for a period sufficient to thoroughly study the case before operation and to be reasonably certain that the dangers of complications were past after operation.

The greatest hazard seems to be hemorrhage and embolism. The use of adrenalin may predispose to this.

Routine fundus examination may uncover sclerotic conditions that otherwise might escape notice.

Local anesthesia should be employed. It is more efficient and spares the patient, when fortified by the rectal analgesia.

Careful, painstaking study and efficient cooperation on the part of the internist and otolaryngologist are absolutely essential.

Unless one is willing and equipped to play the game in this way, without any shirking of monotonous detail, he would better confine his efforts to those cases which are, beyond all doubt, perfectly good, A No. 1 risks. Despite the most careful precautions there are bound to be cases which will cause trouble. Surgery, at its best, has its proportion of tragedy, and the unrecognized and unsuspected presenile case furnishes ample material for this element. But if the possibility of these conditions is always kept in mind and one gives it the careful study and consideration it deserves, not rushing impetuously ahead, at least one's conscience will be clear. It is impossible to attain the ideal in surgery. "Ideals are like stars; you may not succeed in touching them with your hands, but, like the seafaring man on the desert of waters, you take them as your guides, and, following them, reach at last your destiny."

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XLIX.

A CLINICAL CONSIDERATION OF INFLAMMATIONS AND INFECTIONS OF EXTRATONSILLAR PHARYNGEAL LYMPHOID TISSUE BEFORE AND AFTER TONSILLECTOMY.

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SUMMARY.

I. Inflammations and infections of extratonsillar pharyngeal lymphoid tissue which has undergone a compensatory hypertrophy after tonsillectomy may be followed by the same focal infection syndromes that are so frequently attributed to the tonsils prior to their removal.

II. Prior to tonsillectomy severe sore throats occasionally occur in which the inflammation is confined to extratonsillar lymphoid tissue of the pharyngeal walls without any apparent involvement of the tonsil proper.

III. It is often possible to anticipate the amount of post-operative trouble likely to be produced by extratonsillar lymphoid tissue of the pharynx following tonsillectomy, if the entire pharyngeal picture is carefully studied and classified, because patients showing a marked tendency to overdevelopment of this tissue are prone to do badly after the tonsils are removed.

IV. It is probable that infections originating in the nasal sinuses frequently find their way into the blood stream through inflammation of lymphoid tissue of the pharynx, either incited or fostered and fed by a postnasal discharge from the sinuses.

V. Nasal pathologic conditions, such as obstructions, sensitizations and infections, play an important rôle in the production of pharyngeal inflammations, both before and after tonsillectomy.

The importance of inflammations and infections of extratonsillar pharyngeal lymphoid tissue can best be demonstrated

in posttonsillectomy cases. The relative degree of participation of this tissue in the production of constitutional symptoms and the spread of infection by throat inflammations is hard to estimate prior to tonsillectomy, because the tonsils are generally considered predominant active factors in such conditions if still present. However, it is possible that even prior to tonsillectomy the importance of extratonsillar pharyngeal lymphoid tissue has in the past been underestimated. By extratonsillar pharyngeal lymphoid tissue this paper refers more especially to the scattered islands of lymph nodes on the posterior and lateral pharyngeal walls and comparatively ignores discussions of adenoids, although the pharyngeal tonsil might be included by the above term. The reason for this is that adenoid conditions have been about as comprehensively presented as the tonsil situation and therefore needs no further emphasis. To do so would be merely an additional tiresome review. Therefore, in the use of the word extratonsillar it will be assumed that the faucial, pharyngeal and lingual localizations of lymphoid tissue are all considered tonsils.

A great deal has been written recently about nasal sinuses as primary foci in focal infections, especially in children. The part played by infected tonsils in such conditions is too generally accepted for further elaboration at this time. This may also be said of infected teeth. However, there has been comparatively little emphasis upon the rôle of lymphoid tissue of the pharyngeal walls of extratonsillar distribution. In fact, if one goes back ten years and carefully reviews the literature upon this subject he finds few articles listed which are devoted specifically to pharyngeal lymphoid tissue not localized in the adenoids or faucial tonsils. Most of what can be found on this subject appears as side issue remarks embodied in papers on tonsils and adenoids. In fact, it is impossible to avoid concluding from the literature that all the important lymphoid tissue of the pharynx is localized in those two areas.

An extratonsillar pharyngitis may play as important a rôle in focal infections as any other one primary focus. Therefore, when making a good prognosis as to the results of tonsillectomy or adenoidectomy a very important point should always be kept in mind—i. e., all the infected pharyngeal lymphoid tissue may not be localized in the faucial tonsils and adenoids.

After tonsillectomy or adenoidectomy there may occur a very marked hypertrophy of the extratonsillar lymphoid tissue, and occasionally the subsequent production of a long train of pharyngeal symptoms perhaps never before experienced by the patient. The writer feels that all otolaryngologists have had such experiences. This posttonsillectomy compensatory hypertrophy of the remaining lymphoid elements of the pharyngeal walls in infants should be a well recognized possibility by any observing otolaryngologist. However, the dangerous possibility of this occurring in a patient of any age must not be overlooked if there is noted, prior to tonsillectomy, a general tendency to overdevelopment of this extratonsillar lymphoid tissue.

Occasionally, even prior to tonsillectomy, sore throats with severe constitutional symptoms may be encountered in which the source of trouble is apparently an inflammation of extratonsillar lymphoid tissue with no discernible activity of the tonsils. Sometimes when the tonsils also participate in the active picture it is found that there is more throat soreness and tenderness on the posterior pharyngeal walls than in the tonsillar fossæ. These patients are almost certain to do badly after tonsillectomy, and further throat inflammations are to be anticipated. This possibility should be recognized by the otolaryngologist and explained to the patient or other responsible party before the operation (assuming, of course, that accompanying the extratonsillar pharyngitis enough infection apparently exists in the tonsils proper to justify their removal).

The postoperative prognosis in patients appearing for tonsillectomy is a subject worthy of more deep thought and study than is often accorded to it. Tonsillectomy patients may be grouped into four classes, dependent upon the posttonsillectomy prognosis:

- I. Those presenting a very marked diffuse nonlocalized hypertrophy of all pharyngeal lymphoid tissue. That is to say, both the tonsillar and extratonsillar lymphoid tissue is large and prominent. Sometimes the faucial tonsils, lingual tonsils and adenoids are large and also accompanied by prominent masses of lymphoid tissue on the posterior and lateral pharyngeal walls. The so-called cases of lymphatic diathesis with enlarged thymus glands frequently present such pharyngeal pic-

tures. In rare cases the extratonsillar lymphoid tissue may be relatively more enlarged than the tonsillar.

II. Those showing a marked localized hypertrophy of pharyngeal lymphoid tissue, frequently of the faucial tonsils alone, sometimes of the lingual only, and occasionally only of the adenoids. The writer has frequently been greatly surprised after taking out an enormous pair of tonsils to be unable to remove more than a few shreds of adenoids from the nasopharynx. These large tonsils are not infrequently seen in patients with perfectly pale, flat, smooth posterior pharyngeal walls, no moundlike lymphoid follicles noted and no hypertrophy of the lateral pharyngeal folds. In other words, the tendency to lymphoid hypertrophy seems to have spent itself chiefly in one localized area.

III. Those presenting an absence of any visible tendency to hypertrophy of pharyngeal lymphoid tissue anywhere: Small tonsils, small adenoids, lingual tonsil not enlarged and scant lymphoid tissue visible on the posterior or lateral pharyngeal walls. However, very often such patients have severely infected tonsils—crypts red, inflamed and containing much purulent material, which can be shown microscopically to be pus, the cervical lymphatics or their course in the neck may be tender when palpated and the cervical lymph nodes may be enlarged and tender. Also severe arthritis and other focal infection syndromes may be fluctuating in severity with visible activity of these tonsils.

IV. It might be suggested by some that some fine distinctions are being drawn in naming the fourth class. However, to the writer's mind, they constitute a distinct class which has a definite bearing on posttonsillectomy prognosis. In these patients a definite localized lymphoid tissue hypertrophy perhaps of only the faucial tonsils is noticed, but together with it an apparently dormant or suppressed predisposition to a general hypertrophy elsewhere.

If the above classification is grasped and thoroughly understood a great help is possible in prognosis as to the postoperative result of tonsillectomy. At least it can be said that in predicting the result of the operation the above grouping of cases has been of inestimable value to the writer. For instance, he hesitates long and earnestly before he advises tonsillectomy in

the first group. Even if an occasional case is so atypical of any group that accurate classification is not possible, it may be placed approximately where it belongs, and thus the method of grouping may be used as a scale by which some idea of the postoperative result may be conceived.

In the first class, as before briefly described, are seen patients in which the faucial tonsils are large, the lingual tonsil is larger than normal, perhaps the adenoids are enormous, and also scattered islands of lymphoid tissue are seen to predominate in the posterior pharyngeal wall picture. Frequently the lateral pharyngeal folds are markedly hypertrophied as well and may merge into the nasopharynx above as red, glazed, swollen cylinders. In such patients if the tonsils are so markedly and definitely infected that their removal seems advisable, it may have to be suggested, but this should never be done without first sounding a loud warning note that a long train of posttonsillectomy pharyngeal symptoms are to be dreaded or even anticipated. Following tonsillectomy in such cases almost invariably there will be seen a rapid compensatory hypertrophy of the remaining extratonsillar pharyngeal lymphoid tissue. This can progress to a stage of almost tumor-like masses on the pharyngeal walls. The writer has traced the causative factor in many cases of so-called globus hystericus to a hypertrophy of the lingual tonsil. This is not an original observation on his part, but he has noticed it, and especially after a tonsillectomy has been done in group I cases. The symptom, "lump in the throat," is frequently incited by a markedly hypertrophied lingual tonsil, and may be attributed to this very definite causative factor if there is a neurotic temperament along with the lymphatic dyscrasia. The lump they feel is really this lingual hypertrophy.

The second group, which is not infrequent, refers to those patients in whom enormous tonsils are present, but too often accompanied by surprisingly small adenoids, and also at times very smooth pharyngeal walls, apparently clear of all vestige of lymphoid tissue, as far as the naked eye can determine. In this so-called localized tendency to hypertrophy class are also included patients with small tonsils, perhaps comparatively smooth, clean pharyngeal walls, but the entire nasopharyngeal vault may be filled to a surprising degree with a large mass

of adenoids. Again occasionally patients are seen presenting practically no adenoid tissue, very small tonsils, very little lymphoid tissue on the posterior or lateral pharyngeal walls, but a very large lingual tonsil, perhaps filling up both valleculæ and sometimes markedly overriding the epiglottis. Such patients undoubtedly show a tendency to marked lymphoid tissue hypertrophy, apparently spending itself in one localized spot—thus the classification.

This second group has been most puzzling to the writer, from a prognostic standpoint. He feels infinitely more safe and hopeful about the outcome of tonsillectomy than in the first group, but occasionally has been surprised a year later by the patient coming back with a pharyngeal lymphoid tissue hypertrophy springing up elsewhere in one previously showing no such tendency (prior to the operation) except in one localized area. However, often this does not occur and the patient is greatly improved by the tonsillectomy. How to determine which patient of this group will and which one will not develop this hypertrophy after tonsillectomy is at present beyond the writer's limitations, except that he has noticed in cases where there are intranasal respiratory obstructions, sensitizations, infections, etc., a tendency to develop subsequently pharyngeal inflammations, evidently due to the irritation and secondary infection of the lower pharyngeal tissues by the descending postnasal secretions or by nocturnal mouth breathing.

The third group mentioned refers to patients with a noticeable lack of pharyngeal lymphoid tissue hypertrophy anywhere. Adenoids are small, faucial tonsils small, lingual tonsil not enlarged and there is no apparent tendency to excessive hypertrophy of any part of the lymphoid tissue on the posterior or lateral pharyngeal walls, the mucosa everywhere being normally pale, flat and showing no prominent lymph nodes. Perhaps, however, the tonsils are found to be of the submerged, hard, fibrous variety and badly infected. The crypts may be red, much inflamed, and slight pressure or a low powered spray may force from them an apparently virulent yellow purulent material. Perhaps the cervical lymphatics are also tender and cervical lymph nodes enlarged and tender. In such a case tonsillectomy would be advised.

The third variety, in the writer's experience, invariably offers the best postoperative prognosis, especially where focal infection is a problem, because frequently all pharyngeal symptoms and many other complaints end abruptly at operation. He always goes to operation more hopeful of satisfactory results in such cases.

The fourth group refers to patients in whom are found large tonsils and also elsewhere slightly enlarged lymphoid follicles. These follicles are not so prominent as in the first group, but apparently give the impression that they are like a cat crouched for a spring, ready to bob up at the slightest provocation or opportunity. In these patients, after tonsillectomy, an excessive spread of hypertrophy of this extratonsillar lymphoid tissue may be almost positively predicted, and also a succession of sore throats or other pharyngeal ills, often never before experienced by the patient but frequently more bitterly complained of than the pre-tonsillectomy tonsillar infection. This group, of course, resembles group I closely, or rather it presents a picture bridging in between typical group I and group II cases.

Group IV patients are sometimes difficult to classify at the initial examination of a new patient. It becomes easier in an old patient who may have been observed through previous throat inflammations. During quiescent periods the picture of this group may be that of group II or even III, and when an acute exacerbation is in full sway it may resemble group I. If a rise and fall of this tissue has been previously noticed in an old patient it is best to classify him in group IV from a prognostic standpoint rather than in group II or III. By so doing, the possibility of further postoperative trouble would be anticipated.

This fourth group offers, as previously stated, a very dubious prognosis. Usually, however, lymphoid hypertrophy of a troublesome nature may be anticipated. It resembles an old, worn out, leaky hose, which perhaps is spurting a little leak, the size of the lead in a lead pencil, at some place between the hydrant and the nozzle. Plug, stop up or wrap this little leak, which has been acting as a safety valve for the old, worn out hose for days or weeks, and one is likely to see it spring a half dozen larger holes at different weak places in its walls.

In other words, suppress it here, and its tendency springs up somewhere else. Sometimes, in the writer's experience, the expected compensatory hypertrophy does not occur; usually such cases have presented remarkably normal nasal chambers from a respiratory, sensitization and infectious standpoint.

The prognosis of the postoperative results of tonsillectomy in these four groups may be briefly summarized as follows:

Group I.—Prognosis bad under any circumstances. Troublesome enlargement of the remaining lymphoid tissue is almost certain to occur.

Group II.—Prognosis much better than in group I. Usually a good postoperative result may be reasonably expected if there is not also present some marked nasal pathologic condition, such as obstructed nasal breathing, sinusitis, polypi, hyperesthetic rhinitis and hay fever.

Group III.—Prognosis excellent. Troublesome hypertrophy seldom occurs except in rare cases accompanied with extreme nasal pathologic process.

Group IV.—Prognosis very uncertain. Again the nasal pathology may be the determining factor, as it is usually a bad prognostic sign in any group.

Now, following tonsillectomy the pharyngeal pictures to be expected may be roughly grouped into two classes—i. e., patients in whom the operation has been followed by a very noticeable increase in hypertrophy of the remaining extratonsillar pharyngeal lymphoid tissue and patients showing no such noticeable tendency.

The distribution of extratonsillar pharyngeal lymphoid tissue (excluding the localized masses known as the lingual, pharyngeal and faucial tonsils) is more or less general. However, it is probably more prominent, as a rule, along the lateral pharyngeal folds just mesial to each palatopharyngeus muscle. The fact that this muscle lies just to the outer side of these lateral bands of hypertrophied lymphoid tissue may account for much of the annoyance to the patient during acute inflammations of this area of the pharynx. Every throat movement of respiration, vocalization or deglutition probably causes more or less disturbance and irritation by this muscle working inward against the inflamed areas, which does not give the opportunity for rest of the part, as is the case when lymphoid follicles more

centrally located on the posterior pharyngeal wall are affected. The lingual tonsil is rarely operated upon, and after tonsillectomy, if the patient is one prone to overdevelopment of pharyngeal lymphoid tissue, it is usually found enlarged. Lingual tonsillitis is then more likely to ensue and may be easily overlooked. The nodules about the pharyngeal cushion of the auditory tube and Rosenmüller's fossæ may become very troublesome, and especially in the cases showing a tendency to very excessive general enlargement of extratonsillar lymphoid tissue. Rosenmüller's fossæ, especially, may harbor very persistent infections hard to treat. It is often very difficult to get at them in this locality so as to successfully eliminate them once they become established.

As previously mentioned, localization of infection in extratonsillar lymphoid tissue does not always wait until the tonsils are removed to assert itself. Cases of pharyngitis have been studied in which there was no discernible participation by the tonsils themselves. Many case reports could be appended which would vividly bring out this point. These cases usually occur in groups I, II or IV, but sometimes even in group III as well, and it is surprising how bitterly some of this last variety will complain of sore throats at times. One is almost in doubt at the onset of such a condition as to whether there is really a pharyngitis present or that the patient is a hopeless neurotic. Frequently a patient appears, and often one which cannot be considered as markedly neurotic, complaining of a sore throat. The tonsils appear normal, and when palpated with a probe the patient quickly says the soreness is not located there. The posterior pharyngeal wall may not at first glance appear abnormal; but acute observation will show some prominent vessels and reddened localized areas (lymphoid follicles larger and redder than normal for the individual in question if his usual throat picture is known). The naked eye may be baffled at the onset of such a condition, but a magnifying glass is an aid here in detecting small, almost invisible reddened lymph nodes rising up above the surface of the mucous membrane, the small proximal vessels enlarging progressively until the peak of the symptoms is reached, and then fade with their abatement, frequently rising and fading many times with the peak and fall of the patient's complaints. This is a very borderline acute inflam-

mation of small miliary lymph follicles, giving symptoms apparently all out of proportion to its importance. Every year many such cases have been observed, and when the pharyngeal picture returns to its usual appearance the symptoms disappear and the patient regains his normal feelings and complains no longer. Such cases, with strikingly mild objective signs as those described, are predominant in women. However, considerable elevation of temperature and white blood count have been observed to parallel the patient's complaints and slight objective findings. Such observations cannot be ignored, and anyone will observe these findings if he directs his attention to the condition. Real focal infection syndromes do not often occur in these mild conditions. However, they may be seen complicating more severe cases showing a very high degree of easily discernible redness, swelling, and prominent inflammatory changes in this extratonsillar lymphoid tissue, either preceding or accompanying the development of secondary foci.

It should be mentioned that there are other classes of pharyngitis not falling within the scope of this paper, but they will not be dealt with in detail for lack of space. The idea of calling attention to their existence is to bring out the point that all classes of pharyngitis do not fall within the category here discussed. In other words, it is not intended to convey the impression to anyone that there is an attempt being made to explain all the pharyngeal ills of mankind not of tonsillar origin by this extratonsillar lymphoid tissue inflammation. However, if one goes back twenty or twenty-five years to the leading textbooks of that period, and studies the classifications of pharyngitis, he will note a marked difference between them and those of today. The chief simplifications and narrowing of the older more varied classifications of pharyngitis seem to be in a recent focusing upon the importance of lymphoid tissue of the pharynx, both extra and intratonsillar.

Speculation upon this subject can lead into a vast field of conjecture upon many points. For instance, if all pharyngeal lymphoid tissue is capable of being as vicious when pathologic as we have come to believe, just how should we look upon it in regard to its functions as a defense mechanism against invading organisms, toxins and other harmful substances?

And further, what are its other actual functions and uses? In Chapter III of Sluder's book entitled "Tonsillectomy," Dr. Arthur W. Proetz, has very comprehensively reviewed most of the literature to date upon "The Physiology and General Pathology of the Tonsil," which is the title of that chapter. By quoting from all the past and present work to date he shows how much contradiction and confusion have resulted from the work of different men. In other words, he shows that many problems of function, physiology and pathology of lymphoid tissue have not to date been clearly defined. At any rate, in so far as the faucial tonsil is concerned, this is true.

He summarizes by saying that "out of the chaos of thought and experiment have arisen up to the present time five tenable theories" of tonsil function, namely:

I. "The Theory of Protection" (Protection against bacterial invasion).

II. "The Theory of Internal Secretion."

III. "The Theory of Hematopoiesis" (Production of white blood cells (lymphocytes) by lymphoid tissue).

IV. "The Theory of Elimination" (That bacteria, toxins and other harmful substances produced during infection, etc., are excreted from the body by tonsils).

V. "The Theory of Immunity" (that invading bacteria are held in the tonsil until antibodies are produced and the resistance of the patient raised).

These various theories taken from Proetz's Chapter will not be discussed, although the above author takes up each one for very neat and concise discussion in Sluder's book. He also states that during the year of 1922 there appeared in the literature an advocate of every theory mentioned above. Working on the assumption that it is a generally accepted fact that the real essential unit of the tonsil, as far as its function is concerned, is the lymphoid follicle, then it seems reasonable to suppose that in the main any theory as to tonsillar activity should probably apply also to lymphoid tissue elsewhere in the pharynx.

At any rate, regardless of these various theories, it may be said that up to the present time it has been generally accepted, and so we have been taught that the part nature

intended lymphoid tissue to play in its protection against infection was purely one of active defense, almost offense one might say. This seems to be a very rational assumption. However, at times one is tempted to feel that it too often falls short of its intended function as a defense mechanism. It has been taught that the lymph nodes, or their enmeshed lymphocytes, pick up and devour, one may say, as many invading bacteria as possible. Failing in that, they at least lead them to the lymph channels and deeper lymph nodes where a better localized fight can be made against them by the trained fighting forces of the body than if they were permitted to enter here and there, and promiscuously wander into the blood stream or throughout the body tissues at will, and free to pick out their favorite weak sites of attack. When the great number of bodily ills observed to parallel activity of lymphoid tissue inflammation, both extra- and intratonsillar, are considered, one almost has a tendency to feel that it sometimes aids and abets entry of infection and bacteria instead of being the fortified pathways of defense. Of course this does not necessarily follow, as it may be acting as a magnet of defense all the time; failing, however, in its purpose occasionally, naturally it would appear to be the localized site of entering infection.

Another assumption may be offered that the lymph nodes, lymphatic vessels, and entire lymphatic system of the pharynx have no function in nature's plan of defense, but are merely distributed in the pharynx by accident and, therefore, unfortunately constitute a grave mistake on the part of nature in offering there a very vulnerable portal of entry for bacteria. This might bring us back to Dr. A. G. Pohlman's problem of the camel. Did he seek the desert to escape his enemies because he was adapted by nature to survive there better than they, or did he accidentally migrate to the desert in an effort to escape and then develop as we now see him because of his environment?

It should be admitted that perhaps a great deal of the literature is being somewhat ignored, and that many supposedly proven facts are too lightly passed over. However, it has been shown by Proetz's review, as previously mentioned, that often diametrically opposite results have been obtained by

different men in the same type of work on the subject of pharyngeal lymphoid tissue. This would seem to leave one more or less free to draw his own conclusions and speculate a bit more than if all the material facts were definitely settled.

According to the work of Schlemmer there are no afferent lymphatic vessels going to the faucial tonsils. If the same assumption is accepted in regard to the extratonsillar pharyngeal lymph nodes then it leaves open the supposition that these follicles only pick up bacteria coming in actual contact with their surface epithelium. That seems to bring us to the conception that they act as end organs, one may say, for the deeper lymphatic channels. It seems strange that they do not pick up substances penetrating the mucosa in the zone proximal to them. However, assuming that they do, one would presuppose that any regularity in such a function would be explained by a network of afferent lymphatic vessels. It brings us to the conjecture as to what would happen if we could eliminate these lymphoid follicles entirely. If they seem to act as magnets which attack, absorb, and devour bacteria, perhaps a mucosa devoid of them would be more resistance. This would seem to argue against their intended function as localized fighting forces and barriers to entering infection.

At this point in the above debate it seems opportune to mention that the roof of the mouth, hard palate, etc., above the tongue, which are comparatively devoid of lymphoid follicles, are very rarely the primary or even the secondary site of trouble in a pharyngitis. In fact, they are remarkably free of most oral and pharyngeal inflammations, except herpes, stomatitis and lues. There are other anatomical differences between the mucosa of the palate and that of the posterior pharyngeal wall which may have a bearing on their relative resistance to entering infection. The submucosa of the hard palate is more dense and fibrous and binds the superficial layers of the mucosa more closely to the periosteum. However, the buccal mucous membrane of the cheek does not participate in the usual infections of the pharynx and, while its mucosa is more movable and the submucosa contains much fat, there are few lymphoid follicles discernible.

Another point which might be brought out here is that the lower domestic animals, such as the dog and cat, do not have the excessive development of pharyngeal lymphoid tissue seen in man or even the higher primates and apes. It is very seldom that we hear of our dog or cat owning neighbors sending their pets to the dog and cat hospital because of a pharyngitis or any kind of sore throat. Every prominent veterinary surgeon in St. Louis was very carefully interviewed on this question and they were practically unanimous in the statement that they had very little throat work to attend to except cases produced by trauma. Dogs chew hard bones, sticks and other solids which do often produce injuries of the mouth and pharynx.

Sluder brings out in his Embryology, in Chapter II of his book, "Tonsillectomy," that "Hett and Butterfield have shown that the simplest form of tonsil is a flattened tube extending submucously on the lateral wall of the pharynx in a direction parallel with the tongue, forward and slightly upward. It is lined by epithelium, which is continuous with that of the pharynx. Lymphoid tissue is deposited around it. This is the tonsil of the tiger and the leopard, and in these the lymphoid tissue does not reach to the outlet. In the cat and the lynx the tonsil is similar, but the lymphoid tissue protrudes from the lower margin of the outlet. A more advanced form is the pocket shaped tonsil in which the tube has become shorter and is more or less surrounded by lymphoid tissue, the deposit of which is greater on the lower or inner lip of the pocket. This type of tonsil is found in a wide range of mammals: the lemur, some monkeys, opossum, kangaroo and others." The above is a verbatim quotation from Sluder on these lower forms, but he goes more in detail and takes up other forms of animal life, describing the peculiarities of each one as he traces the tonsil up to the bonnet monkey, which shows a well marked plica triangularis, and to the gorilla in which, at three years of age, the tonsil is often indistinguishable from that of a child of the same age.

However, in all these forms in which lymphoid tissue is scarce and relatively ill developed as compared with monkeys and men, as far as the writer has been able to determine,

pharyngitis is also rare and is so roughly about in proportion to the lack of development of this tissue.

Again in the so-called cases of pharyngitis sicca it has been frequently noticed that many such patients do not present any evidence of toxemia or focal infection and are apparently robust and healthy. Also usually the red, dry, glazed pharynx of such a patient does not present any visible evidence of lymphoid follicles. This is essentially an atrophic condition, and many of the normal structures of the mucosa are more or less absent or replaced to a greater or less degree by fibrous elements.

However, it should be admitted also, that other cases of pharyngitis sicca have been observed to be very achy and complain of toxic symptoms, exhibit manifestations of focal infections and even develop deforming arthritides with no other discernible focus to explain the symptoms. Such cases have usually been accompanied by chronic nasal sinusitis which is probably the real active agent of infection and toxemia through the postnasal discharge, secondarily infecting the abnormal pharynx. However, the absence of noticeable prominence of lymphoid tissue on the pharyngeal walls to aid in the absorption and dissemination of this pus has been a puzzling stumbling block to the writer, and has also acted as somewhat of a check upon his opinions becoming too dogmatic, but it should not be overlooked that this pharyngeal wall is not healthy and resistant, but is pathologic and non-resistant. The writer has felt for some time that in arthritic cases the importance of focal infections has been somewhat overestimated and possibly exaggerated, and that many other factors, perhaps metabolic or circulatory, were being too lightly passed over. Dr. Ralph Pemberton has done some very convincing work along those lines recently and is still reporting marked progress. It is certain that the menopause is a frequent starting point for many cases of arthritis in women, which often progress to a deforming condition in spite of all focal infection eradications. This observation would seem to argue for some metabolic cause appearing at this time of life. At any rate, in spite of the fact that the infectious origin and septic character of certain cases of arthritis appear definitely enough established, it still seems

doubtful whether it is justifiable in every case to assume that a septic focus is always necessary, even in the absence of gonorrhea, tuberculosis and lues.

Since becoming interested in this subject the writer has often wondered whether Schlemmer's work on the tonsil should be carried over bodily, and the same conclusions accepted as to lymphoid tissue on the posterior and lateral pharyngeal walls. In other words, has it been finally proven, after all, that there are no afferent lymphatic vessels draining into these lymphoid bodies? He has been unable, with the naked eye, or with the aid of slight magnification, to see definite red streaks going to neighboring lymphoid follicles from apparently localized but virulently infected ulcers of the pharynx, although at times with high powered magnifying glasses he has imagined that perhaps he did. A most striking revelation to him, since using a high powered lens, has been how much more numerous and how closely grouped small lymph nodes apparently are on the pharyngeal walls which, to the naked eye, may appear as pale, smooth mucosæ devoid of lymphoid follicles. These follicles are easily seen when swollen during a pharyngitis, but often are invisible to the naked eye when the throat is normal.

There is a strong possibility that infection is not as well localized in this scattered extratonsillar lymphoid tissue as when only the faucial tonsils are involved. Frequently the lingual and pharyngeal tonsils appear less harmful when inflamed than these islands of lymphoid tissue more generally distributed. Perhaps this will not be proven by future observations, however, it at least seems doubtful whether it is justifiable to continue to argue in every case that tonsils should be removed in focal infection, because they are the most vicious pharyngeal elements known in such conditions. If a compensatory hypertrophy of the remaining extratonsillar pharyngeal lymphoid tissue should occur then, perhaps, there will be a great number of small unremovable tonsils to continue the work of disease. At any rate, in the writer's experiences several times focal infection or toxic symptoms, due to infection, have been relieved by tonsillectomy for a considerable time, only to recur more severely after this hypertrophy of the extratonsillar lymphoid tissue had occurred. While

recognizing the potential posttonsillectomy hypertrophy of extratonsillar lymphoid tissue in certain cases, the writer frequently advised that the tonsils should be removed regardless, even if the compensatory hypertrophy did occur, as it was less of a focal infection menace than the infected tonsil. He hesitates to give the same advice today because he feels that perhaps he has seen cases with a more marked localization of infection in the tonsil during a tonsillitis prior to tonsillectomy than he has been in a posttonsillectomy pharyngitis. He feels that the above assumption explains why many cases of arthritis have continued on rapidly to deformity and subsequent helplessness after tonsillectomy, often much to the chagrin of the attending physician and patient. He is not so sure of the observation that this lymphoid tissue infection can be more of a menace than infected tonsils, and he fears to state it as a definite fact which might prove in the end a grave misleading error; however, he now awaits further evidence to settle it in his own mind. He has had one patient develop a middle ear suppuration within one year after tonsillectomy. This patient was subject to severe attacks of acute tonsillitis and nasal sinusitis each winter, but never before had developed a middle ear inflammation. Tonsillectomy was advised chiefly to prevent just what occurred after the operation. This ear infection followed four or five days of severe inflammation of the extratonsillar lymphoid tissue with very little accompanying rhinitis prior to the onset of ear symptoms. Needless to say that was the end of confidently giving such a reason for tonsillectomy.

Two other initial attacks of severe cervical adenitis have been observed after a tonsillectomy had been apparently well done years previously. In neither child was there any evidence of an incomplete operation or that pieces of tonsil had been left and covered over by scar in the tonsillar fossæ. There was no history in either case of any previous attacks of noticeable adenitis before the tonsils were removed. There was present a very severe acute pharyngitis of the type under discussion in each instance and no other source, such as infected teeth, middle ear suppuration, nasal sinusitis, impetigo, furunculosis or other skin infection of the scalp, face and neck could be discovered. One case was unilateral and the pharyn-

gitis was more severe on the side of the adenitis. In degree this one was as severe as the adenitis frequently seen after scarlet fever. The other case was bilateral with the largest and most pronounced adenitis on the side where the pharyngitis was most severe. Another initial attack of pyelitis was observed in a male child (several years after tonsillectomy), which was evidently due to the same type of pharyngitis. No evidence of middle ear suppuration or any other focus could be determined, and there was no history of any previous attack. Unfortunately the bacteria in the urine were not identified, thus failing to eliminate colon bacilli and the possibility of an ascending infection. However, an ascending infection would be less of a possibility in a male than in a female child.

It may be said that regardless of how one wishes to explain the intended and actual functions of extratonsillar lymphoid tissue, many constitutional symptoms and focal infection sequelæ run a parallel course with corresponding degrees of inflammation of these elements.

The writer is firmly convinced that many cases of nasal sinusitis, so conclusively demonstrated of late as focal infection and toxic sources, actually act in a roundabout way through the descending postnasal discharge of pus from the sinuses, secondarily infecting lymphoid tissue on the pharyngeal walls and entering the circulation from this second focus. In other words, he does not believe that there is much absorption of bacteria from the nasal sinuses directly into the circulating fluids of the body—i. e., the lymph and blood streams. When opened surgically or at postmortem a nasal sinus usually impresses one as inert as marble. The mucosa is pale, cold and inactive in appearance, and there is very little evidence of much circulation. The mucosa is thin comparatively and shows no great number of vessels. The color is seldom more deep than a slight pink, even when recently inflamed. Clinically very virulent attacks of nasal sinusitis run low, perhaps even subnormal temperatures, and often very low white count figures.

Infants and younger children should be expected probably when direct absorption from nasal sinuses in adults is under discussion. It seems that Dean and his associates—Arbuckle

and others—have definitely established that such things occur in children more frequently than has been previously suspected. This is probably due (as Dean has pointed out) to their bones being softer, more vascular and in a period of development and growth.

It is also significant that Dr. W. V. Mullen and his associates, in their excellent work in tracing the lymph drainage from the nasal sinuses, were unable to get any direct absorption from the sinuses into the circulating fluids of the body (either lymph or blood stream) until they had traumatized the healthy sinus mucosa.

On the other hand there is abundance of evidence to indicate a remarkable amount of body absorption through the pharyngeal mucosa. Perhaps the intranasal mucosa covering the turbinates and septum with its erectile nature and great vascularity can be highly absorptive also.

As an illustration of the remarkable absorptive power of the pharyngeal walls a few years ago a case of general argyria was observed which was produced by painting the pharynx over a long period of time (ten to fifteen years) with argyrol. It might be suggested that all this silver salt was not absorbed by the mucous membrane of the throat, but that perhaps excessive quantities were used, the patient swallowing the surplus which was then picked up by the circulation from the stomach and gastrointestinal tract. The writer has been unable to get such a history. A person with some knowledge of chemistry might argue that absorption from the gastrointestinal tract would be unlikely, because probably the silver compounds would be attacked first by the hydrochloric acid of the stomach and the comparatively inert insoluble silver chloride precipitated and passed on out through the bowel without absorption. However, the first cases of argyria known were produced by giving silver nitrate, by the stomach, to epileptics and syphilitics. At any rate this patient was a gruesome sight. She was pigmented from head to foot, possibly much more so and darker on the exposed surfaces, face, neck and hands where the light action would necessarily cause accentuation of the condition, but she was of a complete slate colored appearance everywhere, even on the clothing covered

areas. Although the writer has been unable to find a description of a localized argyria of pharyngeal or nasal origin in either Stelwagon's, Ormby's or other leading textbooks on dermatology, Dr. W. H. Mook of St. Louis assures him that such cases have occurred. He states that localized argyria about the upper lip, face and neck have been reported by reliable dermatologists, due to argyrol and other silver compounds used in the nose and applied to the pharynx. Such cases could only be explained by direct absorption from the pharyngeal or nasal mucosæ, although why the salts did not follow down the accepted lymphatic channels to the circulation for a general, instead of a localized spread, is hard to explain. In other words, why did the salt, even after it was absorbed, not go down the cervical lymphatics to the great veins, right side of the heart, etc., and then be pumped out into the circulation for a general, instead of a local, skin distribution? It only suggests that perhaps migration of soluble substances in the tissues does not follow as regular channels of movement as we have supposed. Argyrol and other silver salts dropped in the eye have been absorbed by the conjunctiva, producing an argyria localized in the skin of the lids and about the palpebral fissures.

The writer must acknowledge, with some regret, that owing to the fact that he realizes he is more of a trained clinical observer than experimental laboratory worker, he has no worthwhile experimental evidence to offer in support of the ideas brought out for discussion in this paper. He has been keenly conscious of his limitations as a laboratory worker. Therefore, he has always made it a rule never to attempt to publish any such efforts of his own unless done in collaboration with a trained laboratory man. It is not always easy to find the right man and get him sufficiently interested in the idea in question to get the desired results. There is no question that some of the gravest mistakes in medicine have been innocently broadcast by well meaning clinicians attempting to prove, experimentally, their contentions in the laboratory which failed when their work was reviewed by a thoroughly schooled experimental laboratory worker. Such things occur because the man did not recognize his limitations as a laboratory worker, although he may have been a keen observ-

ing clinician, able to accurately link up many previously overlooked clinical facts and connections, but could not correctly prove or explain the connection experimentally.

Conclusions as to the gravity of extratonsillar pharyngeal lymphoid tissue in producing constitutional symptoms and disseminating infections are based chiefly upon the following clinical observations:

I. Prior to tonsillectomy constitutional symptoms and focal infection have been seen to parallel (both in time and degree) infection of extratonsillar pharyngeal lymphoid tissue with no discernible involvement of the tonsils.

II. After tonsillectomy and adenoidectomy have apparently been done early enough to eradicate the essential primary focus in focal infection syndromes, the expected improvement has not occurred, and the patient has even become progressively worse, apparently due to a pharyngitis of the type under discussion.

III. Following tonsillectomy and adenoidectomy a compensatory hypertrophy of the remaining extratonsillar lymphoid tissue of the pharynx has occurred and subsequently become inflamed more often and produced higher fever reactions and constitutional symptoms during the attacks than tonsils before operation.

IV. Nasal sinusitis has been observed to run normal or relatively low temperature and white blood count, regardless of whether there was severe drainage block or profuse nasal discharge until an inflammation of extratonsillar lymphoid tissue occurred with a rise of temperature, white blood count and toxic or other constitutional symptoms, not present at any other time during the course of the sinusitis.

V. Within two years after tonsillectomy initial attacks of middle ear suppuration, arthritis, neuritis and cervical adenitis have occurred which could not be attributed to any other source than a severe inflammation of extratonsillar pharyngeal lymphoid tissue. None of these patients had ever suffered from such complications when their tonsils were present.

Other types of cases might be discussed, but the above five seem to be sufficient to warrant emphasizing the importance of lymphoid tissue of the pharynx not localized in the tonsils. The purpose of emphasizing the role of pharyngeal lymphoid

tissue in focal infections and other constitutional pathologic conditions is not merely to present a scientific observation, but to lead us on to the question (conceding that the opinions herein expressed are accurate) of what we are going to do about it. First determine that it is true, then we are ready to attempt to give suffering humanity some benefit from this recognized fact.

TREATMENT.

After this statement the treatment naturally follows. However, this will not be attempted now for lack of space, but it might be mentioned that the literature contains several articles on X-ray, ultraviolet light and other forms of heliotherapy. Cautery, both thermic and chemical, have been mentioned. Internal medication, such as arsenic and ductless gland extracts or endocrine remedies, have adherents. Some believe that lymphoid tissue hypertrophy can be largely controlled by dietetic measures. Excision of excessive hypertrophy of pharyngeal lymphoid tissue, exclusive of the adenoid, faucial and lingual tonsils, is also advocated.

CASE REPORTS.

Appended are a few case reports, many more of similar nature having been observed but omitted for brevity, but each one or more illustrates some point previously mentioned in this contribution.

There might be some criticism of these cases on the ground that many are incompletely reported and points omitted which might be of vital interest. However, they have been presented with sufficient completeness to bring out the points of this paper.

Case No. I.—Mrs. F. E. A., young female of twenty-six years.

Operative history: Tonsils and adenoids present.

History, June 15, 1925: Came to office complaining bitterly of a very painful sore throat and achiness of entire body since the preceding night. No nasal sinusitis noticed as yet, although she had been subject to frequent attacks in the past. No chills, but had felt hot and feverish all day.

Examination, June 15, 1925: Tonsils had not been removed and were normal as far as could be seen. Nose was free and

nasal mucous membrane normal in appearance, with no purulent or abnormal nasal discharge visible. Postnasal mirror revealed no membrane or evidence of infection in that area. Laryngeal mirror showed normal appearing mucous membrane of larynx and no redness or swelling of cords. Postpharyngeal wall to naked eye a little granular due to localized areas of lymphoid tissue redder than normal (usual appearance of this locality was well known in this patient). Thermometer showed mouth temperature of 100.5° , although to skin palpation there was no discernible hotness. White blood count was 12,000. With a magnifying mirror many small miliary lymph nodes were seen to be fiery red with an areola of engorged vessels radiating irregularly from many of them. Diagnosis of posterior pharyngitis was made.

Subsequent course: The next day patient was ill in bed with temperature of 101.5° , and some of the small follicles on the posterior pharyngeal wall, which were no larger than a pinhead, were capped with white apices (resembling the white spots in the crypts of a tonsil during an acute lacunar tonsillitis). Cervical lymphatics in the neck tender, and the cervical lymph nodes draining the postpharyngeal area palpable, enlarged and tender. No tonsillar involvement, no nasal sinusitis, no tracheitis or laryngitis, no cough, evidently an infection confined to the very small miliary lymph nodes on the posterior pharyngeal wall.

Within five days all visible signs described above had disappeared and the patient felt well and normal.

Comment: This case is presented to illustrate the amount of prostration and constitutional symptoms possible to result from an easily overlooked inflammation of the extratonsillar lymphoid tissue on the postpharyngeal wall in a patient still in possession of both tonsils, but without apparent participation in the infection by the tonsils.

Case No. II.—Mrs. F. O'H., female of thirty-three years.

Operative history: Tonsils and adenoids present and had never been operated.

History June 24, 1926: Came to office complaining of a sore throat, fluctuating in severity for ten days until early that morning (Thursday, June 24, 1926), when she had a real chill with a severe rigor, followed by high fever. When

her temperature subsided slightly she felt some better, and came down to the office about noon. No nasal symptoms. Felt achy and bad from the onset of illness. Cervical glands painful and much stiffness in all neck muscles.

Examination June 24, 1926: Patient was evidently ill; temperature 102.5°. Examination revealed an enormous enlargement of both lateral pharyngeal folds; they were very red, glazed and studded with white spots. Picture resembled a lacunar tonsillitis on a smaller scale. Tonsils were present, but not apparently involved or inflamed. Cervical glands enlarged and tender, both anterior and posterior to the sternomastoid muscles. With the naked eye the area of posterior pharyngeal wall, between the enlarged lateral folds, could be observed noticeably inflamed but apparently smooth and normal. However, with a magnifying lens it was seen to be everywhere rolling and lumpy, due to enlarged lymph nodes which were much redder than the intervening mucosa; the fine vessels were prominent and engorged with bright red blood.

Down the right side of the neck, behind and parallel to the course of the sternomastoid muscle, was a linear scar, marking an incision for the resection of cervical tumors six years previous. From palpating a few of these large flabby lumps, which had recurred since the operation, one would say they were probably lipomata. Investigation of the operating surgeons records subsequently revealed that the microscopic diagnosis at operation was multiple lipomata.

Subsequent course: After examination and treatment in the office the patient was sent home to bed and told to remain there for the remainder of that day, and all of the next, and to swallow quantities of cracked ice.

June 26th, patient again appeared at the office, feeling better, but reported that she had suffered severely all the previous day, June 25, and had experienced another chill, followed by high fever. The tonsils were still uninvolved, and no nasal sinusitis had appeared. The throat inflammation had apparently passed its peak in severity and was subsiding somewhat in its appearance.

June 29, 1926. Throat felt better and lymphoid tissue was greatly reduced in size and redness. The white areas had

disappeared, leaving here and there small erosions or minute ulcerations still tender and making swallowing rather painful.

July 1, 1926. Patient appeared at office feeling very comfortable. Throat picture about normal for this individual, although the extratonsillar lymphoid tissue was very prominent and apparently in a chronic state of low grade inflammation.

Comment: This is another case presented to show that even with tonsils present, extratonsillar lymphoid tissue can be the selected area of attack by a throat infection which may not at any time invade the tonsils and yet the patient be as ill as when suffering from any ordinary case of lacunar tonsillitis. This falls within group I.

Case No. III.—Miss Bessie E., female of twenty-four years.

Operative history: Tonsillectomy by writer, November 13, 1924. Tonsillectomy had been advised because patient gave a history of frequent attacks of tonsillitis and of a peritonsillar abscess in the spring of 1924. She had also been observed October 14, 1924, just recovering from her last attack prior to tonsillectomy, and at that time she had large red tonsils which were ulcerated at upper poles. Also there were many hemorrhagic spots on the pillars of the fauces and the uvula was red, swollen and slightly edematous. There was also a white erosion, the size of a dime, on the left anterior pillar. In spite of prominent extratonsillar lymphoid tissue, also inflamed in this attack, a tonsillectomy was thought to be advisable.

History June 29, 1926: This patient came to the office complaining of a sore throat since the morning of June 28, 1926, when she awoke, feeling very achy and feverish. She felt very tired and miserable all that day and was no better upon the twenty-ninth, when she also complained of photophobia, increased general achiness and that she could hardly hold her head up.

Examination June 29, 1926: Patient very evidently ill and should have been at home in bed. Face flushed, lids droopy, temperature 103°, pulse 120. The entire posterior pharyngeal wall was uneven and "lumpy" in appearance, due to fiery red swollen lymph nodes, each one studded with white spots of

pinhead or larger size. No nasal sinusitis as yet, although the nasal mucous membrane was red, swollen and becoming "juicy." The throat picture was similar to that of an acute lacunar tonsillitis on a smaller scale, scattered about in these lymphoid follicles.

Subsequent course and treatment: Patient treated locally in office, given nasal sprays, a zinc phenolsulphinate mixture as a gargle and sent home to bed with instructions to swallow quantities of cracked ice during the remainder of that day.

June 30, 1926. Patient seen in bed at home. Condition about the same as previous day, feeling possibly more achy and miserable.

This patient ran a stormy course for about five days and it was the equal in severity to any ordinary attack of acute lacunar tonsillitis.

Comment: This case is reported to demonstrate that an inflammation of hypertrophied lymphoid tissue of the pharynx, following tonsillectomy, even in a group IV patient, may be as severe and produce identical symptoms and constitutional reactions as an acute lacunar tonsillitis.

Note that the tonsils had been removed just a little less than two years previously, a period of time in which considerable posttonsillectomy compensatory hypertrophy of this extratonsillar lymphoid tissue could gradually occur. Prior to tonsillectomy this patient was classified in group IV because after acute attacks had subsided the lymphoid tissue would reduce in size until it was not noticeably prominent.

Case No. IV.—Miss Emma B., a nurse, twenty years old.

Operative history: Tonsillectomy by the writer, November 4, 1924, because she had been seen through two or three acute attacks of lacunar tonsillitis; the patient having been under observation for more than a year (since January 3, 1923). Her tonsils were usually redder than would be considered normal, enlarged, tender and the cervical lymphatics were tender as were also the enlarged anterior cervical lymph nodes. Besides the local signs mentioned above the patient was very nervous and jumpy most of the time, had a bad color, was losing weight and generally below par. In spite of the fact that the extratonsillar pharyngeal lymphoid tissue was much

enlarged and had been frequently seen inflamed, a tonsillectomy was considered advisable (group I case).

History, September 13, 1926: Appeared at office stating that eight or ten days previously she had developed a severe frontal headache on the right side, which was followed in forty-eight hours by a very sore throat and pain in both ears. With the onset of the sore throat she felt very sick, achy and feverish, and these symptoms had continued without abatement, being the chief complaints causing her to seek medical attention. She had been aware of an enlargement and tenderness in the postauricular and postcervical lymph nodes for several days. She was very much worried about her condition, never having experienced such an attack before, except for a somewhat similar adenitis during an attack of German measles.

Examination, September 13, 1926: Patient's face flushed, lids droopy, evidently ill, mouth temperature 100.5°. The postauricular and postcervical lymph nodes behind and proximal to the course of the sternomastoid muscles were visibly enlarged, rather firm and distinctly tender to palpation. Anterior cervical glands behind angle of jaw and high in neck were also enlarged and tender. No pediculosis capitis in scalp and no sores in that area.

The right lateral pharyngeal fold was red, hypertrophied to the size of a lady's index finger, very tender and painful. The left was smaller but still enlarged. In the nasopharynx no membrane was present, although a grayish tenacious post-nasal discharge simulated one of the diplococcus membranes so often seen in this area. However, it could be wiped off easily with no sign of attachment to the nasopharynx. The thick purulent nasal discharge was bilateral and coming chiefly from the posterior group of sinuses. Otologic examination was essentially negative.

Laboratory reported white blood count 15,000, polymorphonuclears 28 per cent, small lymphocytes 54 per cent, large mononuclears 17 per cent, transitionals 1 per cent.

Treatment and subsequent course: September 13, 1926. Nasopharynx painted lightly with 10 per cent mercurochrome. Adrenalin spray (1/4000) was given to patient to be used intranasally every two hours and followed by 5 per cent neo-

silvol solution with a medicine dropper, four times during the day.

Upon September 14th, patient felt much better and pharyngitis seemed to have passed its peak. Nasopharynx and posterior pharyngeal walls were cocainized, then touched lightly with 40 per cent silver nitrate on a scantily moist swab applied only to certain areas.

September 15th. Patient was feeling comfortable. Temperature normal, no achiness, no soreness of the throat to speak of, anterior and posterior cervical lymph nodes less tender, smaller in size and not subjectively noticeable. Patient more cheerful and less worried.

September 21st. Patient seen in a hospital room, feeling normal and comfortable after undergoing an operation by a surgeon for removal of a cystic tumor of the right breast. This operation was done under local anesthesia with no untoward results. The writer would have strongly advised against the operation being done at that time if he had been consulted.

Comment: Here again was a severe inflammation of pharyngeal lymphoid tissue which came on after a compensatory hypertrophy of this tissue had occurred to a considerable degree following tonsillectomy in a patient of the first group.

Case No. V.—Miss Hanna R., female of thirty-six years.

Operative history: Tonsillectomy June 8, 1924, by the writer. Patient had been treated at various times since January 2, 1923, for nasal sinusitis and nasal headaches, frequently accompanied by attacks of sore throat which were sometimes attacks of posterior pharyngitis only and at others real attacks of lacunar tonsillitis. In spite of the attacks of tonsillitis a tonsillectomy was delayed because of the observation that there was very prominent extratonsillar pharyngeal lymphoid tissue which had been seen inflamed without tonsillar involvement. Antral washings had always been negative. Finally the tonsillectomy was decided upon because it was felt that the general condition of the patient might be improved and there were signs of a progressive loss of hearing with diminished bone conduction which might be due to toxemia from some infectious focus, as the Wassermann was negative.

Appendectomy September 19, 1925.

History, September 14, 1926: Patient came to office complaining of attacks of neuritis (internist's diagnosis) since March, 1926, affecting left leg, from hip to knee. Throat sore for two weeks with pain radiating to ears and feeling of something in throat. Neuritis worse since onset of this sore throat. Not much nasal discharge had been noticed. Patient claimed she had had a gradually increasing soreness on postpharyngeal wall since her tonsillectomy.

Physical examination September 14, 1926: Tonsils had been removed with no remaining remnants discernible. Lateral pharyngeal folds were red, large, hypertrophied, cylindrical and about the size of an ordinary lead pencil. No nasal sinusitis could be found. Internist reported negative findings in his field and nothing else to account for her neuritis except her nose and throat condition.

Subsequent course: September 14, 1926: Inflamed lymphoid tissue cocanized and then lightly painted with 40 per cent silver nitrate.

September 16, 1926. Lateral pharyngeal folds much smaller and of a lighter red color. Still slightly achy and neuritis complained of, but improving.

September 21, 1926. Throat redness and soreness greatly improved. Lateral bands of lymphoid tissue much smaller. Neuritis quiescent. No more general achiness and patient uncomplaining, feeling almost normal again.

Comment: This case is presented as an illustration of a neuritis probably produced by an inflammation of the pharyngeal lymphoid tissue following tonsillectomy in a group I patient. The patient had never suffered from a neuritis or any other focal infection or "focal toxemia" thing prior to tonsillectomy, and when her neuritis was bad it was always accompanied by a noticeable sore throat.

Case No. VI.—Mrs. A. M. J.

Operative history: Tonsillectomy several years previously.

History, June 14, 1926: Came to office complaining of sore throat and general severe achiness since June 11, 1926. Developed a yellow nasal discharge and morning headache about forty-eight hours after sore throat was first noticed. She

also complained of general soreness and tenderness in back of neck and along sternomastoid muscle since the onset of throat symptoms.

Examination, June 14, 1926: There was a profuse yellow purulent postnasal discharge, evidently descending from a bilateral acute postethmoiditis and sphenoiditis, and everywhere on the posterior pharyngeal wall was enlarged, markedly red lymphoid tissue. General tenderness in the back of the neck and in the lymph chains anterior and posterior to the sternomastoids.

Subsequent course: With subsidence of this evident lymphoid tissue inflammation, in about five or six days patient became easy and comfortable. The nasal sinusitis was treated for several days longer before clearing up noticeably, but caused no uneasiness, no absorptive or constitutional manifestation after the pharyngitis had subsided.

Comment: From history of this patient it seems that infection of lymphoid tissue of the pharynx often precedes the onset of nasal sinusitis and may secondarily produce it by the infection spreading upward into the sinuses. It is also an illustration of a patient with a very marked nasal sinusitis feeling perfectly comfortable and absolutely free from fever and constitutional symptoms, except during an accompanying pharyngitis of the type under discussion. The tonsillectomy had been done years before coming under the writer's observation, so her pretonsillectomy grouping should probably not be attempted.

Case No. VII.—Mrs. L. R. P., physician's wife, twenty-eight years of age.

Operative history: Tonsils and adenoids removed in 1915.

History April 22, 1925: Seen at Mullanphy Hospital, complaining of fever, general achiness, dysphagia, sensation of painful lump in throat and obstructed nasal breathing for two or three days. Also distinct tenderness and soreness of many joints, but no visible redness, swelling or effusion. No subjective signs of nasal sinusitis. She had been subject to frequent attacks of sore throat of this character since her tonsils were removed. In fact, her throat was never comfortable. Had been repeatedly examined by good internists with negative results.

Examination April 22, 1925: Patient was of the large adipose, overweight lymphatic type. The entire postnasal space was filled, practically packed with irregular masses of fiery red, glazed, swollen lymphoid tissue. This extended down on the lateral and posterior pharyngeal walls in gradually decreasing amounts to a level just below the lower border of each tonsillar fossa. The lingual tonsil was markedly hypertrophied, overhanging the epiglottis and filling the valleculæ. The lymphoid tissue was hypertrophied in flabby, almost polypoid or tumor like masses. The base of attachment of each mass was everywhere broader than the apex, therefore giving an appearance more than mound like than pedunculated. Both choanæ were practically blocked by irregular tumors of lymphoid tissue protruding into them from the posterior pharyngeal wall. If they had been firmer in consistency, sarcomata would have been suspected. No evidence of purulent nasal discharge at this examination. Tonsils had been fairly well removed. Distinct tenderness in wrists and several of the smaller joints.

Subsequent course: Although there was no evidence at the primary examination of purulent nasal secretion several days later both antra were profusely discharging grayish, yellow, thick pus, and the nasal mucosa everywhere swollen, boggy and juicy, although rather pale. This attack subsided after ten days or two weeks of storm. After the acute attack the lymphoid tissue was reduced greatly in size, but remained always in a state of chronic hypertrophied masses. When not in an acute attack this patient was comfortable only by comparison. She had a fair amount of nasal breathing and was not achy, but her throat never felt normal or comfortable. Applications of 40 per cent silver nitrate during quiet periods have greatly reduced the average size of the masses of tissue, but every so often similar exacerbations of the described attacks occurred. So far the antra have not been permanently opened and drained, due to procrastination on the part of the patient. It is probable that much benefit may follow removal of the causative tendency of this lurking sinus condition. The endocrine aspect of this case has been studied by excellent men, but so far very little benefit has followed attack from that angle.

Comment: This is an example of extreme hypertrophy of extratonsillar lymphoid tissue following tonsillectomy and adenoidectomy in a group I case. It also probably offers another example of how a nasal sinusitis may secondarily produce constitutional symptoms by the postnasal discharge keeping the pharyngeal flame afire, whether or not it primarily lights up the process in every attack. In this case unquestionably the pharyngitis has preceded the sinusitis five or six days on several occasions. However, after the sinusitis got under way it did its share of damage by keeping the pharynx irritated and reinfected. This may become a form of vicious circle in some cases.

Case No. VIII.—Mrs. J. C.

Operative history: Tonsils removed in 1920.

History August 23, 1926: Came to office with a history of sore and painful joints, coming simultaneously with a sore throat two weeks previously. The onset of the sore throat and arthritic pains were followed in two days by a mucous dropping into the pharynx from the posterior nares. The joint history was that of a rapidly moving arthritis, first one knee, then one ankle, an elbow and a shoulder being successively involved, the inflammation leaving one joint as the next became affected. While no distinct swelling or redness of joints had been noted by patient she said they felt hot. Joint symptoms had been subsiding rapidly for two or three days. Considerable postcervical and occipital pain and stiffness still persisted, however.

Examination August 23, 1926: There was a profuse yellow postnasal discharge, evidently produced by a bilateral acute pansinusitis. Everywhere could be seen enlarged red lymphoid tissue on the posterior pharyngeal wall. The vessels were prominent and each lateral pharyngeal fold was about the size of a lead pencil, and very red and angry looking. These hypertrophied lateral folds were so tender that a light application of 5 per cent cocain on a cotton wound applicator was necessary before any local application could be tolerated. The cervical lymph nodes and the course of the lymphatic vessels in the neck were tender to palpation.

Subsequent course: As previously mentioned, the joint symptoms were subsiding when the patient was seen, and

gradual improvement and recovery from all symptoms occurred within a few days. The achiness and arthritic pains ran a parallel course in their abatement with the reduction of redness and swelling of the pharyngeal lymphoid tissue.

Comment: This case is presented to illustrate an arthritic condition, evidently produced by an inflammation of extratonsillar pharyngeal lymphoid tissue. It seems to show that such a pharyngitis is as capable of producing infection as tonsils or any other generally recognized focus. The tonsils were removed by another before coming under observation, so her grouping was not known.

Case No. IX.—Miss H. M., female, twelve years of age.

Operative history: Tonsillectomy and adenoidectomy at five years of age.

Appendectomy at ten years.

History, May 23, 1926: The writer was summoned by a pediatrician to examine the nasal sinuses of this patient, ill in bed, from an arthritis of two days' duration. The arthritis was the lone outstanding symptom which called for medical aid in the minds of the parents. The arthritis had begun in the right hip, probably as the pain had been first felt in that region and in the right groin. It appeared next day, May 22nd, in the left knee, and upon May 23rd, in the right knee. A sore throat had been noticed by the patient on May 18th, but was not severe enough to cause much worry at first. The throat was much more sore upon May 21st, when the outset of arthritic symptoms occurred. Slight "juiciness" of the nose noticed on the 22nd of May, but had not been considered severe enough to treat. Slight pain in left chest had accompanied onset of arthritis or perhaps followed it a few hours, but the pediatrician could find nothing there with his stethoscope.

Examination, May 23, 1926: Patient ill in bed with temperature of 101° and a hot, slightly swollen and reddened right knee, which the family said had been worse earlier that morning. There was considerable redness of the nasal mucous membrane, an excess of clear watery nasal secretion (but no frank pus), suggesting a beginning acute rhinitis. The posterior pharyngeal wall was red, uneven and lumpy, from rounded or oval, and in some places semispindle shaped

areas of enlarged lymphoid tissue. The lateral pharyngeal folds were large, angry looking, red and tender. The posterior pharyngeal wall was rather dry and swallowing painful.

Subsequent course: Within a few days (three or four) the posterior pharyngitis subsided and the arthritic symptoms disappeared with its subsidence. A nasal sinusitis developed and ran a course of several days thereafter, but as soon as the pharyngitis passed away the patient went on about her play and studies at school as usual. She has been well and normal since, and no further arthritic symptoms to date.

Comment: This case is presented to demonstrate the occurrence of an acute arthritis evidently produced by a pharyngitis in which the inflammation of the extratonsillar lymphoid tissue was the outstanding feature.

Case No. X.—Dr. L. L. C., physician, 32 years of age.

Operative history: Tonsillectomy in 1917, and submucous resection of nasal septum in 1916.

Previous history: Has been a chronic sufferer from nasal sinusitis and sore throats for years. He had been treated by excellent otolaryngologists and was usually able to do a prodigious amount of work in his profession, but occasionally each winter would lose several days from illness, fever, achiness and incapacity for work. These attacks were usually diagnosed as acute exacerbations of his nasal sinusitis, but he voluntarily gave the history that a sore throat had usually accompanied his days in bed, both prior to and following tonsillectomy.

History, January 3, 1926: Called to see the patient ill in bed, complaining of headache, obstructed nasal breathing, profuse purulent nasal discharge, sore throat, fever and general achiness of four or five days' duration. His nasal symptoms had preceded the onset of throat soreness by three or four days, but when his throat became sore the previous day he felt so badly he had to give up.

Examination, January 3, 1926: Well nourished male of slight build, but the wiry tenacious nervous type. His face was flushed, he was listless and droopy. Temperature 101°, pulse 110. A submucous resection had been well done, except

for a slight perforation which did not seem to catch crusts, or in any way mar the result of the operation. There was a profuse bilateral purulent nasal discharge coming chiefly from the postethmoids and sphenoids. Tonsils had been well removed. His pharynx was very red, uneven and lumpy, and he had a very painful swollen lateral pharyngitis with a red cylinder of enlarged lymphoid tissue disappearing into the naso-pharynx on each side. There was a profuse thick tenacious postnasal discharge, and his posterior pharyngeal wall was much too dry. He had a red larynx and trachea and a troublesome nonproductive cough. His internist was called and went over him carefully. White blood count was 11,000, urine negative, sputum and chest negative for tuberculosis.

Subsequent course: Treatment of his nasal sinusitis and pharyngitis was begun and within a week the pharynx was no longer painful, acutely red or swollen, and the patient felt comfortable and no longer achy, although the nasal sinusitis did not subside noticeably for two or three weeks thereafter. He was kept in bed and seen daily at home for a week. He felt "knocked out" and stayed about the house for another week, gradually resuming work. When his acute condition cleared, it was found, as he stated, that he had a chronic nasal sinusitis, and he still has it. He has been seen through two or three such attacks since the one described above, but he has not been in bed again. He has started treatment of his nasal sinusitis earlier in its course, has been more careful, and while with each attack he has been slightly achy and has had a slight temperature of 99° for a few days, when the pharyngitis was active, he has been able to keep going about his work, as a busy pediatrician. Forty per cent silver nitrate applications to the lymphoid tissue, when there is no acute inflammation, evidently has greatly reduced their average size. However, the lateral bands of enlarged lymphoid tissue were always threatening in appearance, and far from normal. They were like a cork under water, always apparently trying to bob up at the slightest opportunity.

Comment: This case is presented as a typical demonstration of the irritating effect of a nasal sinusitis (especially of the posterior group of sinuses) upon a pharynx, showing

a tendency to excessive hypertrophy of lymphoid tissue. In this case it seems probable that the infection of the enlargement of lymphoid tissue was incited by the nasal sinusitis. It possibly would have been less troublesome if not irritated from above, as the patient appeared to have a good general resistance, except in his nose, where all his trouble usually started. However, he never felt ill from his nasal sinusitis (if unaccompanied by headache), except when his pharyngitis was active. Neither did he have fever, achiness or constitutional symptoms at any other time.

Case No. XI.—Mrs. C. H., a physician's wife, thirty-eight years of age.

Operative history: Tonsillectomy by the writer, March 12, 1925. This operation was done in an effort to relieve sacroiliac pain and backache from which the patient had been suffering since 1917. Some attacks were very severe, incapacitating, and she was seldom free from discomfort during the year of 1924. She had also been treated through frequent attacks of nasal sinusitis, usually settling down into the antra. After puncturing the antra with a large trocar and subsequent irrigations, these sinuses would eventually clear. However, it was observed that the backache was always most severe at times when the tonsils were noticeably inflamed and somewhat enlarged. Each time this occurred there was usually tenderness in the neck and enlarged tender cervical lymph nodes, anterior to the sternomastoid muscle, high in the neck. The nasal sinusitis and antral infections did not seem to influence the backache in any degree except possibly secondarily through the throat infection. Patient stated that she had always been subject to sore throats, and had noticed the connection between them and exacerbations of her backache. Therefore, it was finally decided to try the effect of removing her tonsils. There was some uneasiness felt about the prognosis of tonsillectomy, because of the fact that along with each flare up of the tonsils an inflammation of the extratonsillar lymphoid tissue was usually noticed, although this tissue was not what could be considered markedly enlarged. (Group IV.)

History, June 10, 1926: Patient came to the office with a history of becoming acutely ill June 5, 1926, with a sore

throat, some fever, much general achiness and a return of the old backache in the sacroiliac region on the left side. Also complained of pain and stiffness in back of neck. She reported that this was her first attack of the old trouble since tonsillectomy, March 12, 1925. She also stated that she had been greatly improved in every way since the operation. About seventy-two hours after the onset of sore throat, etc. (June 5th), sneezing and a watery nasal discharge began.

Examination, June 10, 1926: A marked enlargement of the scattered islands of lymphoid tissue on the posterior pharyngeal wall was revealed, especially of the right lateral fold. This area was about three-eighths of an inch broad and very red, angry and tender. This pharyngeal picture was striking to the writer, because it was so extreme for this patient whose usual throat condition was well known. The tonsils had apparently been removed cleanly, and there were no visible evidence of remnants left or returning. There was considerable watery nasal secretion in both nostrils, and the nasal mucous membrane was pale, or rather slightly livid in color, swollen and boggy. Temperature only 99.8° , pulse 90. This patient ran a notoriously low temperature in all illnesses.

Subsequent course: The patient was treated and sent home to bed, where she was seen daily, June 11th, 12th and 13th, upon which latter date she was feeling much better, and the pharyngeal picture was improving about in proportion to the improvement of constitutional symptoms. The nasal secretion was more profuse, thicker, more purulent, apparently contained more leucocytes and mucus, and was evidently originating chiefly in the antra.

June 20th, patient was feeling all right, practically her normal self, was down at the office, and the backache, general achiness, and all toxic symptoms quiescent. The signs of acute pharyngeal inflammation had practically disappeared, although the nasal sinusitis continued and was apparently just getting into full bloom, one might say. The lymphoid tissue hypertrophy was much greater than normal for this patient prior to tonsillectomy, however.

August 1st, the patient began with another attack about as severe as the one in June, and here again it was ac-

curately observed that the storminess of the backache, general achiness and other constitutional symptoms paralleled the rise and fall of the posterior pharyngitis for several days. However, the nasal sinusitis this time was much delayed—in fact, until August 13th,—when her teeth began to ache, she sneezed, developed a watery bilateral nasal discharge and began to complain bitterly of morning headache. About seventy-two hours later, on August 16th, the usual antral discharge was evident and fairly profuse in amount, but unaccompanied by fever, joint pains or general achiness. Morning headaches had ceased and the pharyngitis had also been quiescent for several days.

Friday, August 20, 1926, in spite of her nasal condition, the patient left for Chicago, feeling keen for the trip, and spent several days there, feeling very comfortable.

Comment: This case is presented as an illustration of several points stressed in this paper. First, that a nasal sinusitis is frequently preceded, and probably produced by this type of pharyngitis, which probably extends upward along the continuous blanket of mucous membrane into the nose from behind through the choanæ. Second, that a nasal sinusitis, although perhaps present, is not necessarily producing accompanying toxic and focal infection symptoms unless it does so by the pus leaving the sinus, secondarily infecting (or maintaining an infection, if already there) the lymphoid tissue on the pharyngeal walls. Third, here is another patient in whom, after tonsillectomy, she was greatly improved and absolutely free from her old headache for more than a year, but after considerable hypertrophy of extra-tonsillar pharyngeal lymphoid tissue had occurred she relapsed into the old trouble for which tonsillectomy was done.

It is significant to note that during this year of freedom from her old trouble she had attacks of nasal sinusitis, but they had never produced a return of the headache until an enlargement of lymphoid tissue had taken place and become active on large enough scale to simulate tonsillar activity in degree.

In the attack of June 10th, the achiness, etc., for the seventy-two hours following the onset of sore throat and preceding the onset of evident nasal sinusitis might be explained as

not due to the pharyngitis, but to marked block in drainage of a nasal sinusitis which could be present, but silent to objective signs. However, the attack in August answers that question, because it is improbable that a nasal sinusitis would stay blocked and silent for thirteen days without headache.

Case No. XII.—Master Chas. D., young male of twelve years.

Operative history: Tonsillectomy and adenoidectomy at the age of seven years. Remnants of tonsils removed in 1924.

Previous history: Severe endocarditis known to have existed for about two years prior to coming under observation of writer. He had been in excellent hands for some months, and remnants of tonsils left and hypertrophied following his previous operation were first removed without evident improvement in his circulatory lesions. His nasal sinuses had next been investigated and treated. Both antra had been repeatedly irrigated when found infected. According to his mother's history, he then improved, finally getting out of the hospital, then up, about and back to school. However, he still carried a heart which demanded constant watching and favoring. He had continued to suffer from frequent attacks of sore throats after tonsillectomy.

History November 23, 1924: Called by his pediatrician to see him ill in bed with a sore throat, profuse nasal discharge and severe achiness of the entire body for two or three days. Complained of most pronounced pain and stiffness in the postcervical region when he turned or moved his head. Headache was not a marked complaint.

Examination November 23, 1924: There was no question about the presence of an acute suppurative pansinusitis as a purulent nasal discharge, fairly profuse in quantity, was evident. It apparently was coming from all sinus outlets. No tenderness over frontal areas or beneath nasal portion of supraorbital ridge. However, the most angry picture of all was his throat. There was much enlargement and marked redness of the lymphoid tissue on the posterior and lateral pharyngeal walls, and enlarged, reddened and engorged blood-vessels everywhere in these areas. His throat was painful, chiefly when swallowing, but always consciously rough

and uncomfortable. The cervical lymphatic gland chains were tender, palpable and enlarged. His temperature was 104° , pulse rapid (about 120), but no racing and heart apparently unflinching under the strain with the myocardium holding up well. He had very loud systolic murmurs over both aorta and apex and also a diastolic murmur in the former area.

Subsequent course: Treatment of the sinus infection produced first a noticeable improvement in his pharyngeal inflammation with a parallel drop in temperature and constitutional symptoms running step by step in its improvement with the amelioration of the pharyngeal picture. Within a few days after the pharyngeal condition improved the patient was feeling normal again, up, about and back in school, although the nasal sinusitis did not clear for many days thereafter.

This boy had two or three such attacks in the course of about ten months, with practically the same syndrome each time. The family had been warned to keep the boy quiet for many days after each attack, because a flare up of his endocarditis could be caused or lighted up by such a pharyngitis as easily, perhaps, as by a tonsillitis. However, a few days following his last attack, after he had been up and about probably earlier than he should this time, as his family was getting less fearful of the heart condition, the writer was called again to see him feeling feverish, achy and nervous. This time the posterior pharyngeal wall did not show any evidence of a relapse of the previous condition, and the nasal sinuses were practically normal. A stethoscope to his chest found a racing laboring heart and an accentuation of his old murmurs. His pediatrician was immediately called and he was sent to Barnes Hospital in a few days where he gradually went from bad to worse, developing finally a pericarditis with effusion, myocarditis, etc., and after two or three months' fight he passed away from his circulatory trouble.

Remarks: To the writer's mind this case is an example of a nasal sinus infection setting up a posterior pharyngitis and entering the blood stream through the lymphoid tissue on the pharyngeal walls; it also demonstrates that an inflammation of this extratonsillar lymphoid tissue may do many of

the destructive things so frequently ascribed to infected tonsils. At no time during the course of his nasal sinusitis were there any constitutional symptoms, except during or following activity of this pharyngitis. No matter what the nasal picture was there was never any fever, achiness or subjective complaint until the pharyngitis began to appear. The history received from the mother was that a "nasal cold" had preceded the sore throat practically always by one or more days, although the writer was never called early enough to actually see this development himself, because the patient would not feel ill until his throat became sore.

It is also noteworthy that this boy's tonsils were removed years before there was any reason to suspect that he had a circulatory lesion. It is also significant that he continued to have sore throats with high fever, achiness and severe constitutional symptoms very frequently after tonsillectomy. In fact his mother claimed he suffered far more severely during attacks and that they were much more frequent during the years following tonsillectomy than in those prior to the operation.

Regardless of how interpreted, it is certain that the sequence of events in the fatal illness was acute nasal sinusitis, acute pharyngitis and then onset of an exacerbation of endocarditis.

201 HUMBOLDT BLDG.

L.

IN MEMORIAM.*

CHARLES MOORE ROBERTSON, M. D., 1865-1926.

Charles Moore Robertson died at the age of sixty-one years at the Highland Park Hospital, Highland Park, Illinois, on Sunday afternoon, October 31, 1926, nine days after an operation for acute appendicitis complicated by peritonitis and pneumonia.

Dr. Robertson came from a family of physicians. Both his father and grandfather were doctors, and it is of special interest to record that these descendants practiced medicine in the state of Iowa. His parents were of Scotch-English ancestry, although born in America. His father, William Stephenson Robertson, moved from Pennsylvania, his birthplace, to Columbus City, Iowa, where Charles Moore Robertson was born on February 5, 1865. His father and grandfather were men of large physique and commanding appearance and were practicing physicians of distinguished reputation and marked skill.

Dr. Robertson inherited many of the striking characteristics and sterling qualities of his parents. To this kind of material in his makeup he added liberally and persistently by his own efforts and application, until he developed into a man who impressed one by his superior physical ruggedness and mental equipment.

He was second oldest of a family of four children—two boys and two girls. Besides his sister, Nellie Robertson, who still lives in the old family home in Muscatine, Iowa, he is survived by his wife, Mary Van Houten Robertson, and three children—Anita, twelve years; Martha, eight years, and Mary Moore, two years.

His childhood was spent in Muscatine, Iowa, where he attended grammar and high schools; while his college and medical education was taken at the University of Iowa in

*Presented at the December, 1926, meeting of the Chicago Laryngological and Otological Society, by Dr. Otto Stein.

Iowa City, graduating in medicine in 1888. After completing his studies he visited abroad and attended the clinics at London, Vienna and Paris. On his return he became affiliated with the faculty of his Alma Mater for several years in the departments of the Eye, Ear, Nose and Throat.

In 1901 he came to Chicago and immediately became identified with the active members of the eye, ear, nose and throat profession of this city. He was elected to membership in this society in the same year (1901), or about three years after its organization. He was always a foremost participant in its proceedings and contributed largely to its development and success. He held the office of president in the year 1911 and was a member of the Council, and also held other offices. For many years he occupied a professor's chair in the department for the ear, nose and throat in the Chicago Policlinic. Later, and up to the time of his death, he was head of this department. He was a former assistant professor of otology at the Northwestern University Medical School of Chicago.

Among some of his contributions to our specialty are the following:

"Fibrosarcoma of the Soft Palate and Tonsil."

"Some Observations on Different Forms of Operation for Deflected Nasal Septum."

"Membranous Rhinitis, Non-Diphtheritic."

"Removal of the Faucial Tonsil; Some Observations and a New Method of Operation."

"Anatomy and Physiology of the Tonsil."

"Malignant Tumors of the Throat Arising From Syphilitic Cicatrices; Report of Four Cases."

"Neoplasms of the Larynx."

"Primary Sarcoma of the Iris."

"Angioma of the Nostril and Orbit."

"Complications of Mastoid Operation."

"Sinus Thrombosis."

"Examination of Men Entering the Aviation Service."

It was the last named subject that interested him intensely. He gave much thought and experimented extensively, developing tests to show the influence of the variations of atmospheric pressure at different altitudes upon the aviator's static apparatus.

Besides his membership in the Chicago Laryngological and Otological Society, he was a member of the American Academy of Ophthalmology and Otolaryngology, the American Laryngological, Rhinological and Otological Society, the American Otological Society, as well as his county and state societies and the American Medical Association.

During the Spanish-American War he was Major in the 50th Regiment, Iowa Infantry. During the World War he was Captain in the Aviation Corps.

He was keenly interested in out of door sports during his first years in Chicago, and participated in the enjoyment of equestrianism and golf. He became a member of the South Shore Country Club, the Calumet Club, the University Club and the Briargate Golf Club.

In his later years, all of his great store of energy was centered in his home and family. He showed a love for the tradition of his ancestry; he developed and maintained a delightful cordiality and hospitality, and he displayed a deep affection for his home and his children.

He was a man with considerable breadth of knowledge, not only of medicine, but of allied and foreign subjects also. He expressed himself logically, clearly and in a courageous and forcible manner; he spoke his opinion often in an unbridled way, quite unabridged, which was delightfully expressive of his independent spirit. Withal, he was a man of sound sense and good balance, an inspiration to the younger members, and a friend worth having.

SOCIETY PROCEEDINGS.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL
SOCIETY.

Meeting of Monday Evening, November 1, 1926.

THE PRESIDENT, DR. ARTHUR M. CORWIN, PRESIDING.

PRESENTATION OF INSTRUMENTS.

Polylaryngoscope.

DR. NORVAL H. PIERCE demonstrated a polylaryngoscope, equipped with eight tubes, through which eight individuals may examine the larynx at the same time. He stated that the instrument was in use at the College of Medicine, University of Illinois, and was proving entirely practical.

"Comparative Embryogenesis of the Pneumatization of the Mastoid and Accessory Nasal Sinuses."

BY NORVAL H. PIERCE, M. D.

"Modern Facilities in Diagnosis and Localization of Brain Lesions; Their Relation to the Ophthalmologist and Otolaryngologist."*

BY E. R. CARPENTER, M. D.,

DALLAS, TEXAS.

DISCUSSION.

DR. ALLEN B. KANAVEL (by invitation) expressed his entire agreement with Dr. Carpenter in regard to the necessity for very careful study of the eyegrounds, the vestibular reaction and nystagmus in the diagnosis of brain lesions.

In regard to the injection of air through the occipital region in relation to the diagnosis of brain tumor, he expressed a very conservative feeling in regard to that procedure. Grant collected over 300 cases in which this procedure had been carried out in patients supposed to have brain tumor, and the mortality was 10 per cent. In that group of cases there was

*See page 332.

only 6 per cent in which the surgeon and neurologist were able to obtain information that was of absolute value in the diagnosis, and in only 2 per cent did they obtain data that could not have been obtained otherwise. Consequently, it seemed to Dr. Kanavel that the injection of air in such suspected cases should only be made where no other method of diagnosis was possible. The danger of death, not only on the operating table but two or three days later, from rupture of a vessel in a glioma, was very great. In a certain small percentage of cases in which nothing else would establish a diagnosis he agreed that one was justified in injecting air into the ventricles.

Concerning the group in which there is no evidence of brain tumor, in which there is headache and other symptomatology incident to various lesions, Dr. Kanavel felt that the group presented by Dr. Carpenter was so indefinite that it was impossible to tell in which cases he would inject air, but he felt that in the average case the procedure ended in the dissatisfaction of the patient and the sorrow of the doctor.

As to the injection of air in the office and allowing the patient to return home the same day, 160 miles or more, he felt that this was a very hazardous procedure and that if Dr. Carpenter had been able to do this successfully he had been very fortunate.

DR. JOSEPH C. BECK said that during the last meeting of the American Medical Association, in Dallas, he visited Dr. Carpenter's office, in company with Dr. Halstead of Syracuse, and was shown skiagrams and some patients who had been treated. He decided that it would be well worth while to invite Dr. Carpenter to come to Chicago and present his material before the Society for discussion. Up to that time Dr. Beck had not seen the perimeter used by Dr. Carpenter, and he had never yet used air in the diagnosis of any tumor that had come under his observation. He was entirely in accord with Dr. Kanavel concerning the danger of the procedure. When Dr. Carpenter told him he carried out the work in his office, and showed him the apparatus, he lost interest in the matter to a large extent. He went so far as to interrogate individuals outside of Dr. Carpenter's office, for he wished to get the full

facts and to hear from the patients themselves, and he was sure there was no question about the results that had been obtained.

Dr. Beck had two cases in which he felt that air should be used as a diagnostic measure. He had consulted Dr. George Davenport about it and he advised against the procedure in those particular cases. Dr. Beck now felt that its use would have been a mistake. In one hypophyseal case (which was presented earlier in the evening) Dr. Davenport thought there was a suprasellar tumor because of the marked ocular changes. The patient had no headache but had atrophy in one eye and temporal hemianopsia in the other. Dr. Beck operated by turning down a flap and exposing the region of the sella, but found absolutely no evidence of any intracranial tumor. He then went through the nose by the transsphenoid route, but did not go as far as the hypophysis. He discovered a large number of polyps that did not show by the usual methods of diagnosis, as they were situated under the middle turbinate body and through the sinus. He did a thorough intranasal sinus operation and stopped. The patient evidently still had the sellar dystrophy, but his vision had increased from 20/70 to 20/30. The diagnosis of hypophyseal tumor was made by Dr. Ellett of Memphis, who also took the fields of vision which were shown by Dr. Beck and were typical of marked contraction of the field of vision.

Dr. Beck emphasized the persistency of Dr. Carpenter in working under great handicaps, and said he was sure he did not use air in as large a number of patients as would appear from the pictures he presented. He expected to have him see a patient of his on the following day, whose condition had resisted all efforts at diagnosis and in which an intraventricular injection might prove necessary.

DR. J. HOLINGER said that in the case of a patient who was under observation in the department of medicine at the University of Illinois, the diagnosis lay between multiple sclerosis and brain tumor. The skiagram showed atrophy of the posterior clinoid processes but no tumor. An article in the *Schweiz. med. Wochenschrift*, June, 1926, explained just such questionable findings. Experiments on the cadaver were reported, in which pressure was exerted in little rubber bulbs inserted

between the dura and the bone of different parts of the posterior fossa. It was demonstrated by means of manometers that the pressure would always transmit in the direction of the sella. Even from points as much as 5 cm. away from the sella the pressure would be transmitted directly towards the sella, thereby causing atrophy of the clinoid process. A tumor may, therefore, be situated at a distance of 5 cm. from the sella and still cause atrophy of the clinoid processes through transmission of pressure by means of the cerebrospinal fluid.

DR. CARPENTER (closing) said that he was particularly interested in this work and wished to emphasize the importance of the air tests. There has been a great deal of criticism in regard to these tests, and he reported doing the lumbar puncture test in his office to show the facility with which it could be carried out. He said he would rather do a lumbar puncture test in his office than a tonsillectomy, and expressed the opinion that a larger percentage of patients die as the result of tonsillectomy than from the lumbar puncture tests, even under local anesthesia. The lumbar puncture test should be made under ether anesthesia in order to avoid the severe reactions. He agreed with Frazier that about 30 per cent of brain tumors cannot be localized by clinical symptoms alone, and that the air tests and similar aids are absolutely necessary. In 100 patients with brain tumors he was able to localize the trouble in practically all cases, and some of the patients were living who he was sure would have died had he not used the air test. A boy with a suprasellar cyst, but with no calcified areas or localizing symptoms, recovered after treatment of the cyst by injection with Zenker's fluid. A man who developed convulsions sixteen years after a brain abscess revealed a cystic cavity which was drained by puncture into the lateral ventricle, with complete recovery. It had been his experience that many brain lesions can be relieved by proper diagnosis, and that 40 to 50 per cent should be cured or greatly improved, whereas not over 10 to 15 per cent are being helped materially at present.

Recently Dr. Carpenter has not had the facilities for doing deep brain work as he would like to do it. Some hospitals are not especially interested in the work and are not properly

equipped for it, and at times he has sent patients to other places, thinking that possibly they could be handled to better advantage. In the cases of six consecutive patients so referred, where thorough study had been made by various tests and the diagnosis and treatment had been outlined, other examiners disagreed with him in four instances, but operation and the future course of the cases showed that he was right in all of them. He believed every doubtful case should be studied and worked out with these tests, because the clinical symptoms so often are misleading. The tests are understood by very few men, and he thought it unfortunate that there is so much unfavorable discussion and criticism about such valuable adjuncts to diagnosis. He believed that in time the air tests would prove to be the greatest asset in the study of obscure lesions of the brain.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL
SOCIETY.

Meeting of Monday Evening, December 6, 1926.

THE PRESIDENT, DR. ARTHUR M. CORWIN, IN THE CHAIR.

Paper: "Pterygomaxillary Abscess as Acute Mastoid Complication."*

BY JEROME STRAUSS, M. D.

DISCUSSION.

DR. J. GORDON WILSON considered it important to have so full a report of this case. Considering the relation of the pterygomaxillary space to the middle ear and tube, one would have thought that such cases were not so rare as they appear to be. A few years ago Dr. Wilson reported to the Society a case of acute otitis media, with pain in the pterygomaxillary region. The child died of acute endocarditis, and at postmortem there was found decrease of the tympanic ring and the adjacent bone, with an abscess in the pterygomaxillary space.

DR. OTTO STEIN asked what was the appearance of the throat.

DR. STRAUSS replied that when the mouth could be opened and the throat examined there were no findings. It was impossible at the time of the acute fixation to get an instrument into the mouth. The postnasal space was palpated under anesthesia but nothing could be felt.

DR. STEIN thought it rather unusual that no evidence of an inflammatory process was found in the throat. He recalled a paper on this subject by Dr. Mosher, seven or eight years ago, that went into the matter quite thoroughly, and also referred to a similar case that he had reported personally before the Society several years ago. In most instances of this type swelling and sometimes fluctuation is found in the throat, because this forms the inner boundary of the pterygomaxillary fossa. It is not uncommon to find the inflammatory process of a peritonsillar abscess or a retropharyngeal process

*See page 477.

extending into the pterygomaxillary space, but not necessarily going on to abscess formation. The lymphatic gland located in that space receives drainage from the back of the nose and the throat, and that is the gland that is supposed to be affected by drainage from the lymphatics at any space around this region, aside from the gravity method which Dr. Strauss mentioned in his paper. Infection can reach this space from all sides, even from a vertebral abscess of the tuberculous type, and from an abscess of the parotid gland.

In handling a case of this type, Dr. Stein thought it was recognized that the abscess can be reached by the method referred to by Dr. Dean in opening retropharyngeal abscesses from the outside of the neck. An incision along the anterior border of the sternocleidomastoid muscle and blunt dissection will reach the region and evacuate the abscess. The possibility of involvement of the jugular vein from this region should be remembered. Dr. Stein recalled a patient of Dr. Barck's, of St. Louis, whose case he reported in connection with a series of complicated mastoid cases. It was an ordinary case of chronic otorrhea in which the usual operation was performed and a lot of tissues removed from the mastoid and antrum. There was extension to the sigmoid portion of the sinus. A few days later, because of change in symptoms, he exposed the sigmoid sinus and removed a clot. Following this blood flowed from above but not from below, so he stopped and packed the wound. The patient became septic and they ligated the jugular vein, but found fluid blood in it. The symptoms gradually progressed, with fatal termination. At necropsy a large abscess was found in the pterygomaxillary fossa and a suppurating sinus was traced from that region up through the emissary vein to the sigmoid sinus.

DR. JOSEPH C. BECK said he did not know this was such a rare condition. He had presented two cases, one of which had been diagnosed as Pott's disease, but abscess was found in the pterygomaxillary fossa when operation was performed. One of the most striking cases of the kind that he had seen was seen in consultation with Dr. Mundt. In that case Dr. Mundt had incised what he considered a peritonsillar abscess behind the posterior pillar. This procedure failed to relieve the severe

pain and limitation of motion of the upper jaw. The patient died. A complete necropsy was not permitted but sufficient evidence was shown to demonstrate that the abscess extended over the eustachian tube and into the pterygomaxillary area, where it had ruptured.

The whole subject was worked up well and brought out by the late Dr. Holmes of Boston, who showed the various routes through which infection can travel in this area. The late Dr. John B. Murphy also brought out some work on ankylosis of the lower jaw known to be due to infection in the pterygomaxillary fossa which was neglected and allowed to remain for a long time. If the infection occurs in children and is neglected it interferes with development of the jaw, and if it is bilateral the jaws are small and receding.

Dr. Beck complimented Dr. Strauss on his interesting and instructive presentation.

DR. SAMUEL SALINGER, referring to the point brought out by Dr. Stein regarding swelling and fluctuation, said that he had a case similar to that reported by Dr. Strauss in which, however, the symptoms did not appear until two weeks after the mastoid operation. The patient complained of sore throat, and examination revealed a slight swelling which he thought was a peritonsillitis. Later there was spontaneous rupture, which proved that it does not necessarily follow that an abscess must open into the pharynx early.

DR. JOHN A. CAVANAUGH believed this condition could be best explained by anatomic defects occurring in the development of the gasserian fissure. Gruber has stated that in cases where the crista tympanica and tegmen tympani fail to unite, the tympanic cavity affords communication by this fissure with the pterygomaxillary fossa.

DR. NORVAL H. PIERCE said that in examining the anatomy of this part, one could readily believe that pus originating in this region or above it could take almost any course, posteriorly, anteriorly, downward. Given a perforation of the zygomatic cell or, better, squamal cell, the course of the pus will be determined by its relationship to the deep fascia at the base of the skull, which will direct it downward and forward, inward or outward. The symptoms in each type will be alto-

gether different. If it is inward, there will be swelling beneath the anterior pillar; if outward, there will no swelling in the pharynx but swelling externally. It seemed to Dr. Pierce that the best explanation of these cases was to be found in the presence of squamal cells, and he thought not enough was heard of these cells. Some of them are capable of enormous development. One may explore as much as he thinks justifiable but the patient may fail to improve, and have continuance of pain and fever. He had never seen a perforation in the zygomatic fossa proper, but had seen a number of perforations of the squama and two cases of perforation of tubal cells, with pointing in the pharynx.

DR. JEROME STRAUSS, in closing, expressed his appreciation of the discussion, and said the case was considered only as a complication of acute otitis media and mastoiditis. There was a note of conservatism in the report, owing to the fact that the case occurred in a private patient and close friend, and it was felt from day to day that it would be safe to wait another twenty-four hours before introducing radical methods. After ten days it was evident that pus was present and that the abscess would point laterally. There was no tenderness and no obstruction to nasal breathing, such as would be found with an abscess of the superior pharyngeal wall. Dr. Strauss thought a secondary infection from the sigmoid sinus could probably be ruled out, as there were no general symptoms to indicate a phlebitis. It was impossible to find the opening through which the pus burrowed into the mastoid wound in the premature rupture of the abscess.

Paper: "Recent Literature Review; Cranial Resonance and Its Clinical Application."*

By ROBERT SONNENSCHN, M. D.

DISCUSSION.

DR. J. GORDON WILSON believed there were many problems in cranial acoustic conduction still unsolved. In Dr. Sonnenschein's interesting review there was lacking in some of the papers a clear perception of the means by which the cranial

*See page 454.

bones can be set in vibration. It is known that they can be set in vibration by direct application of a sounding body—e. g., a tuning fork. It is conceivable that vibrations of a sounding body not in direct contact with the skull can be conveyed by air to the skull and so set up cranial vibrations which ultimately reach the ear. Therefore, two varieties of cranial vibrations are possible: (1) by direct application to the skull of a sounding body; (2) by air conduction from a sounding body not in direct contact with the skull. These are obviously distinct. They ought to be but are not always differentiated. There is ample evidence that vibrations from a sounding body directly applied to the cranium can pass through the cranial bones to the cochlea, but Dr. Wilson doubted if sound vibrations of even considerable intensity impinging on the skull are perceived by the ear. He has failed to convince himself that sounds of ordinary intensity conveyed to one ear by a tube or a telephone are transmitted to the other ear by bone conduction. This is a problem which is frequently met in using the audiometer. If one is testing an ear which has been found by the ordinary clinical tests to be totally deaf while the other ear has good perception, it not infrequently happens that with the telephone receiver applied to the deaf ear, on increasing the intensity the patient appears to hear and locate the sound in the deaf ear, but the intensity is very much increased. He did not know how much perception there was, but believed there was no physical evidence that sounds of ordinary intensity can be heard by bone conduction through a tube or telephone receiver.

It has been stated that air vibrations carried to the ear by a tube may be heard by an observer through a stethoscope applied to the skull, the sound vibrations supposedly being transmitted by cranial conduction through the stethoscope to the observer's ears. There were several difficulties about this that he thought were not easily explained. If this is bone conduction it is very much less than the sound vibrations conveyed to the stethoscope with a tuning fork held between the teeth. The closer the stethoscope is applied to the skull in the case of the tube the less distinct is the sound, while with the fork between the teeth it is the more distinct. There has as yet been no satisfactory explanation of an otologic test whose diagnostic value is recognized, the increased bone con-

duction when the stapes is fixed, and the entire subject is very intricate. Dr. Wilson thought it well to be critical before relying on new tests. At present the old tests are still the most reliable and in the majority of instances will carry one safely through.

DR. J. HOLINGER agreed with Dr. Sonnenschein and Dr. Wilson in regard to relying on the old, well known tests because their results have been checked up by postmortem findings. The examination by means of phonendoscopes and stethoscopes or any other instrument for hearing containing rubber tubes must be cautioned against, for they have been tested and the rubber tubes found very deficient. Tobler (*Schweiz. med. Woch.*, Oct., 1926) made tests and found that, especially for the higher pitches, the conduction of the rubber tube compared to the conduction of pieces of wood of the same size was very deficient. The tests have been made by means of electrical apparatuses. Dr. Holinger thought that, in listening to heart and lung sounds, the hearing of these sounds might prove of value. He believed it was time to take a stand from the point of view that valuable information is lost by the use of the rubber tubes.

Referring to the audiometer and other diagnostic measures that can be used by the nurse, Dr. Holinger expressed the opinion that dealing with a patient personally gives the physician much insight into his psychology and state of mind, which is lost when this work is left to an assistant or a laboratory.

DR. SONNENSCHNEN, in closing, expressed his agreement with Dr. Wilson regarding the conduction of sounds by means of rubber tubing. The great objection that so many persons have offered to this has been with a hard rubber perforated tip in the ear, connected by rubber tubes to the tuning fork, the sound is transmitted by bone conduction. Physical experiments carried out a number of years ago by Dr. Minton and himself, which were submitted to various physicists, showed that when using a rubber tube practically all of the sound waves were transmitted by air through the lumen of the tube and very little escaped through the wall of the tube. It was shown that this was true by the fact that in many cases of middle ear impairment the hearing via tubing was somewhat

less than that with the prongs, whereas if the hearing had been via bone conduction it should have been increased with the tip in the ear. Dr. Sonnenschein thought it was well known that in testing with the whispered voice in conversation the sound waves strike the skull and some are transmitted through the bones to the ear. When sound travels from one medium into another it is not well transmitted. Sounds travel least rapidly in gases, better in fluids and best in solids. If one strikes a bell under water the sound will travel three or four times as fast as through the air. If a bell is struck in the air a person under water will not hear it well. One must always consider whether a sound originates in one medium and is heard in the same medium, or whether it arises in one medium and one attempts to hear it in another. The small amount of sound that strikes the skull is not well appreciated.

In reference to the deficiency of rubber tubing in transmitting sounds, he did not see what difference it made whether one used rubber tubing or not, for the reason that when testing skull resonance one must use a medium pitch because the natural frequency of the skull to the sound is about 200 d. v. If one uses a high pitch, the sound will not get much vibration. In making the tests with Dr. Minton, they used a tube 51 cm. long, with a lumen of 0.7 cm., and a wall 1.5 mm. thick. The question of the length of the tubing is not of great physical importance, but one not too wide should be used, lest it act as a resonator.

Scheibe: "My Teaching of Empyema. Caution Against the Use of the Word 'Mastoiditis.'" (Zeitsch. f. Hals, Nasen und Ohrenheilkunde, Vol. XIV.

REVIEW BY J. HOLINGER, M. D.

Scheibe examined parts of the wall and even whole cells of the mastoid process, which were gouged out by means of large, flat gouges, during the state of inflammation. He takes a strong stand against the word "mastoiditis," and recommends instead the expression, "empyema of the mastoid process," or "necrosis." The inflammatory swelling of the lining of the cells produces an absolute or relative occlusion of the necks

or openings of the cells, thereby causing retention of the pus, empyema of the cells, increased pressure, absorption of bone all over the wall of the cell and fistulæ in the outer plate. The narrowness and unfavorable position of the perforation in the drumhead have nothing to do with the empyema. They are irrelevant for the drainage of the pus from the mastoid cells. Only the empyema of the tympanic cavity and the antrum breaks through the drum membrane and is drained. This seemed to Dr. Holinger to explain the fact that many a swollen and extremely painful mastoid process is much improved after a careful inflation and the application of an ice bag for a few hours. The swelling of the lining is diminished, thereby allowing drainage of the pus and relief of pressure. *Streptococcus mucosus* usually produces more swelling than other microbes, thereby more often clogging the mouths of the cells and producing empyema. Pressure in the cells causes them to enlarge eccentrically and produce fistulæ. The sensation of pulsation which the patient experiences stops as soon as drainage is established. If it persists after operation it indicates that another cell contains pus and that the operation was incomplete. As a rule, only one cell is affected. All these deductions hold good in otherwise healthful individuals. In badly emaciated patients the course is different. The microscopic examination shows the lining of the empyema cell thickened up to eighty times its original thickness, the walls eroded by lacunæ, the marrow in the neighborhood inflamed, but in no case did the cavity communicate directly with marrow spaces. To Dr. Holinger this seemed to contradict Wittmaack, who attached so much importance to the crevices in the bone. He thought it would be difficult to explain extradural abscesses and brain abscesses several inches away from the ear except by contiguity through the diploë, and asked if it could be done only by progress of the suppuration along the emissary veins.

Scheibe draws the following conclusions: In operating it is sufficient to drain the cell, or exceptionally cells, that contain the empyema and leave the marrow space, the other cells, and especially the antrum, alone. His time of recovery is on an average nineteen days, recurrences in the scar 3 per cent and 0.55 per cent mortality (one death in 200 operations). After a discussion of the pathologic changes of the bone in con-

nection with Sharpey's fibers, Scheibe gives his reasons why the expression "mastoiditis" is wrong. It is not an inflammation of the whole mastoid process. The marrow spaces are not implicated. Only one or several cells are, and if these cells are located in the pars petrosa or along the eustachian tube is it logical to talk of "mastoiditis"?

Otto Fleischmann: "Investigations of Blood Chemistry in Ozena."
(*Zeitsch. f. Hals, Nasen und Ohrenheilkunde*, Vol. XIV.)

REVIEW BY J. HOLINGER, M. D.

The study of the causes of ozena pays more and more attention to the possibility of constitutional anomalies. The observations and investigations in this direction have not furnished results which exclude other explanations. The anomalies of the skull, especially the too wide nose, were held responsible, but they are found also in individuals without ozena. Siebenmann says the ozena nose is an abnormally wide nose, but not every wide nose is an ozena nose. Other anomalies of the skulls are found, such as absence of the frontal sinus, shortness of the septum and palate, but not in ozena noses exclusively. Christ and Nager drew attention to other constitutional changes, such as absence of fat and perspiration glands in the skin, irregularities of the formation of teeth and hair, which frequently are observed in connection with ozena, but probably not always. Siebenmann also found that 60 per cent of all ozena patients suffer from nerve deafness.

Another indication to constitutional causes is the relation of ozena to the endocrin glands, as evidenced by the large percentage of ozena in female patients; also, some changes in the sympathetic nervous system, and the fact that several authors claim to have seen improvement in ozena after the injection of adrenalin and hypophysin. However, all these arguments are open to other explanations. This is also true of heredity and the more frequent occurrence of ozena in certain families, for which several family trees are given in the article. All these points are much more in favor of some constitutional cause for ozena and against the theory of infection. Fleischmann reasoned that this fact would probably also appear in a chemical analysis of the blood. I will not

enter into all the technical details of the complicated and difficult work, but will simply give you the conclusions that he draws.

1. The mineral metabolism of the blood must be considered as normal.

2. After investigation of the metabolism of lipid substances, cholesterolin and lecithin, it very soon became apparent that there was some relation between ozena and an absence of cholesterolin in the blood. The fresh cases of ozena showed the lower, the advanced cases the higher values of cholesterolin. All, however, remained below the lowest normal values. The lecithin metabolism of the blood does not show the same regular deviations from the normal as the cholesterolin, although some abnormal changes were noted. No parallelism could be found with the clinical data. The cholesterolin content of the blood in other chronic inflammatory processes of the nose and paranasal sinuses was investigated. In atrophic rhinitis, also, a deficiency of cholesterolin was found. The more serious clinical processes showed a greater deficiency, which is the reverse of what was found in ozena. Six cases of suppuration of the sinuses were examined for comparison and all showed normal conditions. The general conclusion, therefore, is that a deficiency of cholesterolin in the blood is characteristic of ozena and atrophic rhinitis, while patients with hypertrophic rhinitis had normal values. This seems to prove that atrophic rhinitis and ozena are closely related and differ only in intensity.

The manner in which the cholesterolin deficiency in the blood affects the cells, and thereby explains the occurrence of ozena and atrophic rhinitis, is very interestingly given by Fleischmann but is too long to be repeated here. It is evident that it is not necessary to accuse any of the infections of childhood or suppurative processes in the paranasal sinuses of being the cause of atrophic rhinitis or ozena. The suppurations in the paranasal sinuses in ozena are only a part of the general process and not the cause of the disease.

Several investigations demonstrated that cholesterolin is a part of each cell membrane and affords protection for the cell and the blood corpuscles. A deficiency of cholesterolin opens the way to all kinds of infections. Therefore, an ozena nose

is an incubator for all kinds of bacteria, even for those that otherwise are never found in a normal nose or thrive there only under special conditions. On the other hand, this deficiency also explains why individuals suffering from ozena are so liable to other infections, as, for example, tuberculosis. The deficiency of cholesterin is the cause, the infection is the effect, and not vice versa. The deficiency of cholesterin is most marked in the beginning and thereby creates favorable conditions for the propagation of different microorganisms. Later on, the defenses of the organism increase, the cholesterin content comes up to nearly normal and forms a kind of healing process. Treatment with vaccines is logical. There seems to be no doubt that ozena is due to an anomaly of the constitution. The infections are secondary. This does not mean that the deficiency of cholesterin is the only and exclusive cause of ozena, for a wide nose and certain microorganisms must help to make the picture perfect. The glands of the skin eliminate the cholesterin. A congenital absence or diminution of those glands must have an influence on the blood content of cholesterin. Everything centers about the question as to the cause of the deficiency, and here heredity points to endocrine factors, especially the thyroid, the sexual glands and the spleen. It must be remembered that lecithin and cholesterin are in a sense antagonists and are dependent upon the vegetative nervous system. The fact that certain occupations predispose to ozena, that poor or poorly nourished individuals are more often affected, and that during famines the number of cases of ozena have been nearly doubled, make the dependence upon nourishment very probable. Further investigations in this direction are necessary. Examination of the carbohydrate metabolism showed that there is no connection between that and ozena.

DISCUSSION.

DR. NORVAL H. PIERCE said that the Munich Clinic had always been very conservative in mastoid surgery, especially in the acute cases, leaving as much bone as possible and removing only that portion of the bone that was obviously affected. From that viewpoint to the other extreme, where everything was removed, the antrum being reamed out so that only

the inner tablet of the skull was left, was a long step. He was sure that he had seen cases in which if they had removed only that portion that seemed to be diseased osseous tissue there would have been a relapse and complications. He considered it a matter of good judgment as to what to take and what to leave, but a vast mistake to remove all the bone enclosing the mastoid antrum if such bone could be conserved. It is only necessary to have a perforation of the floor of the antrum to explore and to drain it thoroughly.

As to the rest of the operation, he thought one should always take the bone away down to the bony walls of the sinuses, whether it was softened or not. He had made the mistake of leaving the pneumatic spaces at the time of the operation, to be heard from later.

Referring to Dr. Holinger's interesting review of Fleischmann's work, Dr. Pierce said that during the last week in the otolaryngologic laboratory at the college they had made serial sections of the aural organ of a fetus somewhere around the eighth month, and there was apparently complete aplasia of the structures normally present in the lateral walls of the nose. Straight walled cavities with only the bud of inferior turbinate bodies, without any development of the antrum, and no sign of development of the ethmoid cell were found. This, he thought, demonstrated the fact that there are congenital malformations of the antra of the nose, and he believed the idea brought forth by Fleischmann would be greatly developed in the future. Nasal troubles, particularly of the hyperplastic type, will probably be found to have a congenital basis. Very rarely are profound tissue changes due to any one cause.

DR. ALFRED LEWY thought Dr. Fleischmann's observation of cholesterol in the blood in the presence of ozena was interesting, in the light of some work that was presented to the German Otolaryngological Society last year in connection with excess of cholesterol in the blood of patients with ceruminous plugs in the ear. He thought it would be well to examine patients with ozena to see if they had the ceruminous plugs.

DR. HOLINGER, in closing, said that the formation of cholesterol in the cholesteatoma cavity or in the external meatus in the cerumen is a process that takes place after secretion, and is due to decomposition of fat, with absence of oxygen.

PHILADELPHIA LARYNGOLOGICAL SOCIETY.

Meeting of January 11, 1927.

COLLEGE OF PHYSICIANS.

Paper: "Recent Vaccine Therapy in Otolaryngology" (By Invitation.)*

By RALPH A. FENTON, M. D.,

PORTLAND, ORE.

Paper: "Vaccine Therapy in Otolaryngology."†

By JUDSON DALAND, M. D.,

PHILADELPHIA.

DISCUSSION.

DR. JOHN A. KOLMER (by invitation): A large number of very interesting and likewise very practical points have been raised in the excellent contribution of Dr. Fenton. One of the important points of his paper has been to emphasize the matter of technic in relation to bacteriologic diagnosis of infections of the upper respiratory tract, and more especially in relation to vaccine therapy.

I think that, on the whole, vaccine therapy in case of otitis media, sinusitis and infections of the nose and throat has failed because of carelessness. The laboratory worker cannot be expected to find infective organisms in a test tube if they are not present. Organisms like streptococci and pneumococci require special culture media, and unless we furnish these we cannot ordinarily detect or isolate these bacteria. They usually grow better in fluid than in solid media, blood broth and blood serum being particularly serviceable. Of course, the culture should be taken in the proper way and under the proper circumstances, and this can only be done by the rhinologist. As a rule, two or more organisms are present, and the important problem arises as to which is responsible for the infection. The work done by Dr. Meyer Solis-Cohen is the first serious attempt to solve the perplexing question, although I do not

*See page 387.

†See page 404.

agree with all the conclusions that Dr. Cohen has reached at the present time.

I want to emphasize in otolaryngology the importance of cultures early in otitis, sinusitis, etc., because it is possible to get the real organism early in the disease before mixed infection had occurred. The laboratory worker usually does not find it difficult to isolate and identify the organism, prepare a vaccine and keep it in the refrigerator for use if the disease proves stubborn.

I know of no more difficult lesions to influence in vaccine therapy than infections of bone. Whenever the mucous membranes are thin or bone is involved vaccine therapy must of necessity be prolonged. I think it is an axiom in vaccine therapy that the deeper the lesion the more amenable it is to vaccine therapy. For this reason I am an advocate of the use of vaccines early in bacterial infections.

With reference to stock vaccines, I would say they are not as preferable as a properly prepared autogenous one, but I would much rather use a well prepared stock vaccine than a poorly prepared autogenous vaccine.

What has been said regarding dosage this evening meets with my own experience. I am a believer in the larger doses. I like to see a reaction twenty-four hours after the vaccine has been given. I like to see a little distress in the sinus following the injection. I usually have my vaccines made up in the concentration of one thousand million to a cc.

Bacteriophage has been mentioned by Dr. Fenton. It is true that the results observed following bacteriophage treatment of disease have met with disappointment. Bacteriophage is supposed to be an organism infinitely smaller than bacteria, which feeds on living bacteria.

One point in relation to infections of the upper respiratory tract that I would like to mention in relation to focal infection is that the ethmoid and sphenoid sinuses play a more important rôle than infections of the antrum. Their spaces are smaller and the extent of lymphatic absorption is greater.

In conclusion, I wish to emphasize that after a primary focus of infection has been removed, time is required for the thorough removal of the germ or toxins, or both, from the secondary foci, and it is particularly in these cases that an autogenous

vaccine may be very valuable in the treatment of secondary lesions of focal infection.

GEORGE M. COATES, M. D.: Dr. Coates said that he could not add anything very much to Dr. Fenton's able paper. The subject of vaccine therapy had always interested him since Dr. Wright read his manuscript, many years ago. Of course, there was a lot about vaccine therapy that nobody knew, and for that reason it was sometimes difficult for the otolaryngologist to outline a definite course of treatment.

He mentioned the fact that several years ago, with his colleague, Dr. Ersner, he devoted considerable time to the subject. There were various reasons for failure in vaccine therapy. Frequently the culture media selected was not the best adapted for growing the particular organism which was causing the disturbance. He believed, however, that the selection of the proper culture media did not lie within the province of the otolaryngologist but rather with the pathologist. Sometimes a patient would not respond at all to the first or second course of vaccine treatments and then would get a complete cure after a fresh vaccine from a new culture was used. Dr. Coates advocated a reculture in all cases which did not respond favorably and believed that such a proceeding would minimize the number of failures.

In connection with the subject of dosage, he felt that a reaction was not a bad thing, because in his experience a vaccine with a "big kick" often brought about the desired result.

Vaccine therapy should always be combined with judicious surgery. In cases of chronic mastoiditis with necrosis of the mastoid cell walls, vaccine therapy alone was bound to be an extremely long and tedious process, but if the diseased tissues and the necrotic bone were removed the chances of getting the patient well were extremely bright. Vaccine therapy proved very advantageous in those cases with poor resistance and lowered vitality that were not ready for operation. Administering the vaccine first and operating at a later period was more apt to bring about satisfactory results.

MYER SOLIS-COHEN, M. D.: We are all indebted to the essayist for bringing to our attention the importance of removing the bacterial focus of infection.

Most rhinolaryngologists have in mind only diseased tissue or infected cavities when they think of focal infection, although they must know that the microorganisms in such tissue or cavities are the real cause of the infection. This misconception makes them give reports that are often misleading. They will state, for instance, that there is no focus of infection in the upper respiratory tract, when what they really mean is that they are unable to see tissue that looks infected or to find pus. Yet all the while infecting organisms may be present there, constituting a bacterial focus of infection. When, too, the otolaryngologist announces that he has removed all foci of infection from the nose and throat, what he really means is that he has removed all visibly infected tissue and drained all infected sinuses. But notwithstanding this, the infecting organisms may persist in the upper air passages for months and years following his operation and continue to produce secondary infections.

It is only when the patient's resistance has been so raised that the infecting organisms are destroyed or their toxins neutralized that the bacterial focus of infection is removed. This may occur naturally after operation. Frequently, however, it must be brought about artificially through the administration of a vaccine made from the infecting organisms.

In some cases resistance is so low that it must be raised by means of vaccine before an operation can be attempted. Otherwise healing may be delayed or may fail to occur or complications may set in. Were this done more often there would probably be fewer lung abscesses following tonsillectomy and fewer cases of meningitis following operations on the sinuses.

To be effective, however, the vaccine must consist principally of the organisms that are the cause of the infection. Ordinarily no attempt is made to differentiate the infecting organisms from the other organisms present, which, while of pathogenic varieties, are not at the moment infecting the patient, who stands to them in the relation of a carrier, merely. The bacteriologist commonly makes the vaccine from all the organisms present or from the predominating organism, without making any attempt to determine that it really is the infecting one.

It is this determination and differentiation that is attempted by the pathogen selective method of culturing, in which all the organisms present are planted both on a rich culture medium and in the patient's whole, coagulable blood. The organisms whose growth is unrestrained by the patient's blood are believed to be pathogenic for that patient and constitute 90 per cent of the vaccine I employ, the other 10 per cent consisting of those organisms whose growth was restrained by the patient's blood and which are, therefore, regarded as non-pathogenic for him. The excellent results that have followed the use of vaccine so prepared make me believe in the correctness of this theory.

Vaccines must, of course, be properly administered, as Dr. Kolmer and Dr. Daland have pointed out. Many failures attributed to vaccine therapy are no doubt due to improper administration. For this the bacteriologist frequently is responsible, for he often issues instructions with the vaccine as to the amount to be given at each dose. Yet no one is able to determine any dose but the first without observing the reaction from the preceding dose.

I usually begin with a dose of 50,000,000, except in cases of asthma, where 5,000,000 is much safer. Subsequent dosage always depends upon the reaction produced by the preceding dose. Three types of reaction must be looked for: General—the occurrence of drowsiness, tire, general aches, etc.; focal—an increase in the symptoms referable to the diseased part; and local—the appearance of areola, induration and tenderness at the site of injection. Sometimes only one type will be present. In determining dosage, attention must be paid to any type of reaction that occurs.

DR. FENTON: I simply want to voice my gratitude for the very generous response to this paper. I am particularly grateful to those gentlemen who have honored this paper by their discussions.

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